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BULLETIN

OF THE

ILLINOIS STATE LABORATORY

OF

NATURAL HISTORY

URBANA, ILLINOIS, U. S. A.

STEPHEN A. FORBES, PH.D., L.L.D.,
DIRECTOR

VOL. X. MAY, 1915 ARTICLE VI.

THE CHIRONOMIDÆ, OR MIDGES, OF ILLINOIS, WITH PARTICULAR REFERENCE TO THE SPECIES OCCURRING IN THE ILLINOIS RIVER

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ARTICLE VI.—*The Chironomidæ, or Midges, of Illinois, with particular Reference to the Species occurring in the Illinois River.* By J. R. MALLOCH.

INTRODUCTION

The family *Chironomidæ* includes a very large number of species the adult forms of which, in the great majority of cases, are very difficult to distinguish from each other. The adults of the larger species of the genus *Chironomus* and those genera closely related to it are often mistaken for mosquitoes, which they greatly resemble in general appearance. No adult of this group, *Chironominæ*, nor of the *Tanypinæ*, has as yet been recorded as biting, and it is only in the *Ceratopogoninæ*, the species of which are generally very much smaller and more robust, much less resembling the *Culicidæ*, that we meet with blood-sucking species. Some of the species in this latter group, known locally as "punkies," are very persistent biters, and though of very small size occur sometimes in such numbers as to cause considerable inconvenience. This habit of some species in the *Ceratopogoninæ* is not confined to those occurring in America. In Europe, particularly in the more northern parts, *Culicoides pulicaris* Linné and several closely allied species are so numerous and bite so persistently in the evenings, during the months of June, July, and August, that it is only by enduring much discomfort that one can remain outdoors in the country, or even on the outskirts of the towns in certain districts. This condition prevails in Britain, and is more pronounced in Scotland, especially near the many small lakes which exist, where conditions are almost unendurable. Several species which attack man and cattle are dealt with in this paper.

The early stages of most species of this family are passed in water —rivers, lakes, pools, and streams, or in almost any receptacle containing the requisite amount of water; but some species of the *Ceratopogoninæ* are terrestrial in the larval stage, living underneath bark, under boards, or beneath other objects lying on the ground, while some of them are also met with in nests of *Hymenoptera*. A most peculiar form of larva belonging to this group and living on submerged logs, has been found by Garman in Kentucky*, and has also occurred in the

*Bull. Ky. Agr. Exper. Sta., No. 159, p. 31, Figs. 27 and 28.

Illinois River at Havana. A detailed description of all stages of this species is given herein. The *Chironomidæ,* though resembling the *Culicidæ* in many respects, including the form of the adult and the aquatic habits of the larvæ, do not present in the larval stage such characters as those which are so readily appreciable and so easily accessible in the larvæ of the latter family. It is only in the terrestrial species of *Ceratopogoninæ* that one meets with conspicuously spinose forms, and in the great majority of cases a clue to the specific, and even generic, identity of a larva must be sought in the structure of the head and its parts, and also in the form of the anal appendages.

The members of this family are among the commonest and most widely distributed of the two-winged flies, occurring on every continent and in all the faunal areas into which these continents have been divided. Although considerably over one thousand species have been described, it is certain that this is but a small fraction of the total number of species which must occur throughout the world. The reasons for this paucity of described species are obvious. The fragile structure of most of the species prevents their being readily preserved, and their frequent close similarity deters all but a few specialists from working on the family. Despite the extremely fragile structure of the members of this family many fossil species have been described by various authors. Conjectures as to the possible sources from which the family sprang must remain, as in the case of other families, mere conjectures, serving only to create purely academic discussion, which has no proper place in the present paper. It may, however, be useful to students of the *Diptera* to indicate, as clearly as possible from the available data, the characteristics of the family.

In this paper I have introduced in descriptions of genera and species a few characters which have not previously been used by writers in dealing with the family. I have in every case endeavored to find coordinated characters in the sexes, and in dealing with the genera I have, wherever possible, associated the characters found in the adults with a certain set of characters found in larvæ and pupæ. I have, I believe, met with a considerable degree of success in deciding some of the more difficult points, particularly in the *Ceratopogoninæ.* The presence of the thoracic cavities in *Culicoides* and their absence from the members of closely allied genera serves as a much more satisfactory and more readily appreciable character for the separation of the genera than that previously in use, namely, the size of the empodia in comparison with the size of the claws. I have of course followed previous authors in the main lines of separation, only occasionally deviating when convinced that such course is expedient and conducive to a better understanding of the family; but in descriptions of species I

have used, wherever possible, such structural characters as were available in addition to those of color, even at the risk of being charged by superficial students with considering valueless minutiæ as of specific importance. My duty to subsequent students of the group is, as I regard it, to avoid obscuring the distinctions between genera or species, and to place before them as clear a statement as I possibly can of the characters on which I depend for my identifications, thus enabling them to begin their work upon the family without the handicap which I had when I began—that of uncertainty as to the structural details of genera and species.

METHODS OF COLLECTING

Larvæ of *Chironomidæ* may be met throughout the entire year in almost any permanent body of water, and often in temporary pools. Slow-flowing rivers and creeks and shallow lakes and ponds are both the most easily accessible and most productive of species. Early in March many species may be dredged from the beds of streams and ponds, and some of them, such as *Protenthes culiciformis* and *Orthocladius nivoriundus*, may be obtained in large numbers in practically any small stream. It is necessary in dredging for larvæ that the mud or silt at the bottom should be disturbed to some depth, as most of the species burrow and must be dislodged before they can be obtained with the net. Provided, however, that the net is strong enough, quantities of mud may be lifted from the water and sifted over on some convenient flat surface. The "blood-worms" are readily seen in the net, but most species are difficult to detect because of their brownish or grayish color, and it requires careful searching to find most of the species of *Orthocladius* and the smaller chironomine species. The wormlike larvæ of *Ceratopogoninæ* are also difficult to discover as they are almost colorless and exceptionally slender. A good plan to adopt is that of leaving the material spread out on some smooth surface for a short time undisturbed, when the small larvæ may be readily detected by their movements.

Pupæ of *Chironominæ* and *Tanypinæ* are usually obtained by dredging. Only in rare cases does one obtain them by searching on the surface of the water, as they seldom leave the burrow or come to the surface till just immediately before the emergence of the adult. The emergence of the imago, which occupies but one or two seconds, usually follows so closely upon the appearance of the pupa at the surface that few specimens are obtained while floating. In the aquatic *Ceratopogoninæ*, however, the simplest method of obtaining the pupa is to search along the shore of a body of water upon which a steady breeze has been blowing for some time, or to examine floating objects upon

which the pupæ may have crawled. Because of the habit which the species of this subfamily have of ascending beyond the water-level before emergence of the imago they necessarily remain longer at the surface, which affords a better opportunity for collecting them.

Imagines of *Chironomidæ* may be obtained throughout almost the entire year. *Ceratopogoninæ* rarely fly in the well-known "cloud" which is characteristic of many species in *Chironominæ*, but occasionally species of the genus *Forcipomyia* may be seen flying in large numbers close to the trunks of old trees. The writer has commonly taken *F. pilosa* in such situations, both sexes being represented. It is a peculiar habit of both the terrestrial and aquatic members of this subfamily to pass the heat of the day in thick vegetation. In the case of the biting species of *Culicoides* at least, I have found that there is a preference for evergreens, or at least for those having the leaves very closely placed, such as juniper or spruce. At almost any time during the year specimens of this group may be obtained in suitable localities by beating such trees in the usual manner adopted by collectors. The *Tanypinæ* and *Chironominæ* are readily obtained almost anywhere, on windows in the daytime, by sweeping vegetation close to streams, or at lighted windows at night. There are very few species of *Chironomidæ* that can not be found at light, and quite a number of species which are generally considered rare have been taken by Mr. C. A. Hart, of this office, and the writer, on store windows in various towns in Illinois.

METHODS OF REARING

It has not been possible for me to experiment extensively with live material, but a fair measure of success has been obtained in rearing species by the simple expedient of placing single larvæ in two-dram vials about a third full of water, in which was placed a small portion of the mud or dead leaves from the habitat of the larva, the mouth of the vial being closed with a plug of cotton. It is not to be expected, however, that this method will prove successful in the case of larvæ which live in swift-running streams, and several species which were obtained from this sort of habitat never reached maturity. Mr. Hart met with considerable success with larvæ contained in fine gauze rearing-cages which were moored in the Illinois River. This method is the ideal one and should be adopted by any one who is intending to study the biology of *Chironomidæ*.

METHODS OF PRESERVATION

Larvæ of all the *Chironomidæ* may best be preserved in vials containing 85 per cent. alcohol. It is necessary to boil the larvæ first to

prevent shrinkage. In doing this it is only necessary to bring the water in the test-tube to the boiling point and then let it cool. To make microscope slides of the head parts it is not necessary to clear the head in caustic potash or any other medium, as the various parts when dissected are sufficiently transparent to permit of their thorough examination without clearing. Larval exuviæ are of course the best objects for microscope slides. To prepare these for mounting it is necessary first to immerse them for twenty-four hours in 85 per cent. alcohol, or for a shorter time in proof alcohol. After this a bath for about half an hour in clove oil will be all that is required to fit them for mounting in Canada balsam.

It is a very difficult matter to make a satisfactory mount of a pupa, containing the imago, and from the point of view of its availability for examination I prefer the cast skin. In mounting this the same method is followed as with the larval exuviæ.

In making preparations of the imago for the microscope it is necessary to clear the specimens in a ten per cent. solution of caustic potash. Large and heavily chitinized objects will require longer boiling than small membranous ones, but no specific time can be given as that necessary under any set of circumstances. It is only requisite that the student observe the object from time to time by holding the test-tube to the light and looking through it, judging when he has obtained the desired transparency. It is best to use specimens which have been dry-mounted. The hypopygia, which are used to a considerable extent in descriptions in this paper, are easily mounted by the following method: Boil in caustic potash as indicated above, wash in tepid water for five minutes, dehydrate in proof alcohol for five minutes, and immerse in clove oil for ten minutes for small objects, longer for large ones. Have the Canada balsam rather thick, place a small portion on center of slide, and on top of it a drop of xylol. Remove the object to be mounted from the clove oil with a needle dipped in the balsam and arrange on slide under low power. This simple method will, I have found, give highly satisfactory results. To prepare dry-mounted specimens of the imagines for the collection it is best, except in the case of very large examples, to mount them on their sides on card points, using shellac, and keeping the upper surface of the thorax away from the pin. By this method there is less danger of breaking the legs of the specimens—a most important point to observe.

SYNONYMY AFFECTING FAMILY NAMES

The family name *Chironomidæ* and the subfamily names *Ceratopogoninæ, Tanypinæ,* and *Chironominæ* are used in this paper, although

they have been relegated to the synonymy by certain European authors because of the opinion held by a few dipterologists regarding the claims to priority of the names of a recently resurrected paper by Meigen.*

I have not used the generic names of that paper which are stated to pertain to this family for the following reasons: Article XXV of the rules governing zoological nomenclature adopted by the International Zoological Congress states that a generic name unaccompanied by either a description or a figure is valid if the name of one or more described species is mentioned as pertaining to it. Article XXX states that the type of any polytypical genus is that one of the original species which was first designated as such type, and that where there are two species, one of which is subsequently cited as the type of another genus, the remaining species shall be considered as the type of the old genus. It will thus be seen that what really validates a genus is the indication, by the author of the genus, of its type species, or the inclusion of a species which may be cited by another author as the type even should there be discrepancies between the type and the generic description. Thus genera without species are invalid. By this ruling, misinterpretation of characters by careless workers is rectifiable; whereas if genera were to be erected by mere description, fanciful interpretations might seriously interfere with entomological or other scientific work necessitating accurate identifications. As none of Meigen's genera in the paper referred to had species assigned to them, they are necessarily invalid. Meigen himself did not use the names subsequently, nor were they ever, as far as I am aware, mentioned by other authors until Hendel reprinted Meigen's paper in 1908.†

In this connection Hendel endeavored to link up Meigen's names of 1800 with those used by the latter in 1803,‡ suggesting that the names of the 1803 paper now in common use be ranked as synonyms of those of 1800. Irrespective of the fact that in very many cases the association of the names in the two papers was merely a guess, I consider that Hendel's action made the genera valid only from the date when he placed a species in them and not from 1800. These names therefore must be ranked as synonyms of the 1803 names and date from 1908. In view, then, of existing rules of nomenclature the course I have taken in dealing with this family is the only one possible, and it will be adopted by me in dealing with other cases of synonymy connected with Meigen's paper.

*Nouvelle Classification des Mouches à deux ailes. 1800.

†Verhandl. k. k. Zool.-Bot. Gesellsch., Wien, Bd. 58, p. 48.

‡Illiger Mag., Bd. 2.

BIOLOGY* AND TAXONOMY

The Egg Stage

The eggs of *Chironomidæ*, with the exception of those species belonging to the terrestrial forms in *Ceratopogoninæ*, are deposited in water, principally in pools or slow-flowing streams. At times they may be deposited in indoor aquaria, or other suitable receptacles having an accessible water surface. There is considerable variation in the form of the egg mass in the different species, but in all recorded cases the eggs are enveloped in a gelatinous outer covering, and may take the form of a pear-shaped mass, be arranged in rope-like tubes, or be massed closely together, forming large groups. In one case observed in the Illinois River the eggs of *Cricotopus trifasciatus* Panzer were grouped together, forming a large elongate mass about ten inches long and from one to two inches in diameter. Miall and Hammond give an account of the various egg masses which they have examined.† I reproduce the passages here. "The various forms of egg rope which characterize different species of *Chironomus* reach a climax of complication in *C. dorsalis*. In simpler cases the eggs may be enclosed in a globular or pear-shaped gelatinous mass, which is glued to a stone in the bed of a stream. Or the eggs may lie, almost at random, within a gelatinous pipe. Both a pipe, enclosing the eggs, and an outer gelatinous envelope may be present, and the pipe may be thrown into bends or spires which do not affect the outer covering. Lastly, a pair of interwoven cords may be added, which traverse the cylinder, on whose outer wall lie the spires of the egg-containing pipe. The egg masses may contain three different kinds of gelatinous substance, one forming the pipe, a second the general investment, a third the interwoven cords. The two latter may be furnished by the gluten-gland, whose cavity when cut across shows sectors of what are probably two different secretions; the wall of the egg-pipe is perhaps secreted by the ovary or oviduct.

"Since the larvæ which have to issue from the eggs have to live in water, it is convenient that the egg-chains should be laid in water, and further that they should float at the surface, where they can be freely supplied with air, and run no risk of being smothered by silt or organic refuse. If the water were stagnant, the eggs might float free, as the egg-raft of the gnat does, but the eggs of *Chironomus dorsalis* are laid in slow streams, and must be secured, lest they should be swept away, and perhaps lodged in some unsuitable place, or even car-

*Notes on the biology of *Chironomus viridicollis*, a species often present in reservoirs for the supply of city water are given on pp. 459–463.

†The Harlequin Fly, pp. 154–155. 1900.

ried out to sea. The eggs of this species are therefore invested by a gelatinous envelope, which swells out, the moment it touches the water, into an abundant transparent mucilage, and the whole mass is moored to some fixed object by twisted cords. The mucilage has its special uses: it makes the egg-mass slippery, so that birds or insects cannot grasp it; moreover, it spaces the eggs, so that each is well exposed to the sunlight and air; lastly it keeps off the attacks of the water moulds *(Chytrideæ* and allied *Oomycetes),* which abound in water and on the surface of decaying plants, or devour the substance of living insects and fishes. It may be that the mucilage of the egg-mass has some antiseptic property, for it remains unchanged by parasitic growth or putrefaction long after the eggs have hatched out."

The general statement above quoted applies very well to *Chironomidæ* in America, though it is evident that the writers had only in mind the British members of the family when they suggested the possibility of the eggs being swept out to sea. It is probable that their theories as to the uses of the gelatinous envelope of the egg mass are mostly correct, though I doubt its suggested efficiency in preventing destruction of the eggs by birds and insects.

The amount of time devoted to the study of the egg stage in *Chironomidæ* has not been sufficient to permit association of the characters possessed by them with those possessed by the larvæ, pupæ, and imagines.

The number of eggs contained in the egg mass of seven different females computed by Miall and Hammond (*loc. cit.*, p. 154) was as follows: 668, 784, 817, 828, 912, and 1102. The duration of the egg stage, given by the same authors, is six days (p. 175). The length of the egg stage will in all probability fluctuate in accordance with weather conditions.

The method of reproduction in certain species in the genus *Tanytarsus* presents an instance of larval pædogenesis in this family. The American species in which this occurs is given by Prof. O. A. Johannsen* as *T. dissimilis.* A European form of this genus having larval pædogenetic phases has been recorded by Professor Zavrel. A species of *Chironomus* in Europe has been recorded as having pupal pædogenesis.

Larval Characters

Head.—The dorsal surface of the head consists of three longitudinal plates, to the median one of which *(clypeus)* is attached the *labrum.* The labrum in the genus *Chironomus* has on its under surface a complicated arrangement of hooks and two articulated *lateral arms,*

*Science, Vol. 32, 1910, p. 768.

which are represented in figures 7 and 8, Plate XXIII. The labrum hangs over in front of the head, and can be drawn backward so as to close over the mouth orifice. The function of the hooks present on the *epipharynx*, or under surface of the labrum, is probably that of retaining food in the mouth, but they are also used in assisting the larva in its movements within its burrow, and also over any surface, as in progressing it generally grasps the sides of the burrow or some other object with the mouth parts, drawing the body forward at the same time. To the lateral plates are attached the *antennæ* and *mandibles;* on each lateral plate there are generally two black pigment spots, which are rudimentary eyes; the lateral plates curve down over the side of the head and meet in the center of the under surface, which junction is marked by a faint suture. The *antennæ* are in many larvæ very small, in others of considerable size, and in *Tanypus* and its allies are retractile within the head for almost their entire length. The usual form of antenna consists of a large and stout basal joint, on which there is generally a sensory spot, or a hair, and on the apex of this joint one simple, generally hairlike, process of varying length, and a process with three to five distinct joints, which presumably represents the true continuity of the antenna. The *mandibles* in all the species which I have examined are large and heavily chitinized, generally toothed on their inner surface, and move on an articulated base so as to close inward; when completely closed their apices are visible behind the anterior transverse margin of the labial plate. The brushlike hairs which are present on the mandibles of the larvæ of *Simulidæ* and *Culicidæ* are much less prominent in the larvæ of *Chironomidæ*, though still distinguishable. The *maxillæ* are much retracted and rather rudimentary in many species, and but little use has been made of them in descriptions. The character which has been used more than any other for the separation of larvæ of this family lies in the structure of the *labial plate*, or *submentum*. In *Chironomus* and several other genera, *Orthocladius* and *Cricotopus* in particular, this plate is exposed and is therefore easily accessible; but in all the species of *Tanypinæ* which are represented in the material before me, the labial plate is very small and generally retracted within the mouth, or occupies a vertical position so that its form is indistinguishable; the *labial papillæ* of a species of *Chironomus* are as in Figure 10, Plate XXIII. A further discussion of this matter will be found under *Tanypinæ*. The larval head of *Dixa* differs very considerably from that of any chironomid, and shows the dorsal sclerites clearly (Pl. XXIII, Figs. 9 and 12).

Abdomen.—The thorax and abdomen of the larva combined consist of twelve segments, which are almost devoid of hairs in most of the aquatic species. Several of the terrestrial species are figured here-

with to show the variation of the abdominal bristles (Pl. XVII, Figs. 1–3). It is only in certain species in *Cricotopus* and *Tanytarsus* that I have been able to detect strong hairs on the abdomen in addition to the anal tufts. The *anal tufts* are two conspicuous groups of hairs, situated upon more or less elevated bases, on the dorsal surface of the last segment. In each of these elevated bases is a small ganglion which would seem to indicate that the hairs are sensory in nature. In the aquatic forms of *Ceratopogoninæ* neither *thoracic* nor *anal pseudopods* are present; but in the terrestrial forms of that group, and also in the larvæ of other *Chironomidæ*, both are present, and generally well developed. Sometimes the two of each pair are so fused as to present the appearance of a single pseudopod; while in others, and particularly in the case of the anal pair in some species of *Tanypus*, they are remarkbly elongated. The apices of at least the anal pair are crowned with two or more rings of retractile hooks which enable the larva to retain its hold upon any surface. The thoracic pair in the case of terrestrial *Ceratopogoninæ* have also strong hooks similar to those on the anal pair; but in *Chironomus* and some other genera the thoracic pair has only numerous, rather soft, apical hairs. The eleventh segment in certain species of the genus *Chironomus* has either one or two pairs of *ventral blood-gills*. In *lobiferus* Say, there is only one pair of these gills, which are situated rather higher on the side of the segment than usual, but in many species these organs are very much elongated and situated low, almost or quite on the latero-ventral surface. In addition to these ventral blood-gills, which are, as far as I know, confined to a few species in the genus *Chironomus*, there are generally present on the surface of the twelfth segment two pairs of well-developed *dorsal blood-gills*. These organs, as far as my observation goes, are represented by at least one pair in all cases except the *Ceratopogoninæ*, though in at least the aquatic forms of the latter they are probably retractile. The form of the dorsal blood-gills varies considerably in the different genera, and even in the different species within a genus.

The only exception to the foregoing description of the aquatic larvæ is to be found in the case of *Palpomyia* and allied genera, in which the entire body is snakelike, and the only protuberances present consist of four pairs of hairs on the last segment (Pl. XVII, Fig. 6). These larvæ swim with a peculiar twisting, serpentine movement, reminding one very forcibly of the motions of an eel.

The larvæ of many aquatic species live free in the water, while others form tubular tunnels in the mud where they lie concealed during the daytime, many of them being found near the surface of the water after dark, supposedly for the purpose of obtaining a supply of

oxygen. The larvæ of *Tanytarsus* form a characteristic case attached to stems of grass or other objects in the water.

Transformation to the pupa generally takes place within the tunnel, the sides of which consist of the saliva of the larva, which seems to harden on contact with the water, and in which there is generally no trace whatever of threads. During the last larval instar the development of the imaginal disc is very rapid, and in a series of larvæ of any species taken at the same time it is not unusual to find specimens which represent an almost continuous series of the changes which take place. The most striking thing about the transformation is the development of the imaginal head. In the earlier stages of its formation the head with all its parts lies within the larval head; but gradually, as growth proceeds, it is so withdrawn that the compound eyes lie outside of the larval head and within the larval prothorax. The imaginal head is generally conspicuously larger than that of the larva, which in a measure explains why the complete transformation does not take place within the latter. Miall and Hammond have dealt at considerable length with the transformation here referred to.* It is exceptional to find a species in which the head of the imago remains entirely within that of the larva for the greater part of its period of formation, though some cases of this kind are recorded.†

I have not met with any species—even in *Tanypinæ*, in which the larval head is larger than in other groups—in which the head remains long within the larval head after transformation begins, but I have found one specimen which in some unaccountable way had failed to withdraw the head in time, and, in consequence, the head with its members was tightly compressed within the cavity of the larval head, the neck being much elongated. The specimen was in alcohol, so that it was impossible to say whether or not it could have successfully emerged.

At the time of the emergence of the pupa the larval skin splits longitudinally on the dorsum of the thoracic segment, and generally along the middle of the dorsal surface of the head. Miall and Hammond state that at this time the head splits along the central suture,‡ which feature I have observed also, but in some cases both the dorsal and ventral surfaces are ruptured. I have not sufficient material to decide whether there is any distinguishing character in the rupturing of the head in the different species or genera.

*The Harlequin Fly, pp. 118–137. 1900.

†Miall and Hammond, l. c., p. 135.

‡Loc. cit., p. 27.

Food of the Larvæ

The food of the larvæ of *Chironomus* consists of diatoms, algæ, and other vegetable matter. *Tanypus* is recorded as feeding upon the smaller "blood worms" *(Chironomus* spp.*)*, in addition to taking the same food as the latter.

Characters of the Pupæ

In the *Tanypinæ* the pupa resembles, in a general way, that of some of the *Culicidæ,* the thoracic segments being much swollen and carrying a pair of simple *respiratory organs* on the front part, above the location of the anterior spiracles of the enclosed imago. The *wing cases* are distinctly separated from the sides of the thoracic segments as in the *Chironominæ.* The thoracic respiratory organs are simple in all the genera with which I am acquainted except *Chironomus.* In this genus they consist of a stalked base terminating in very numerous threadlike filaments. The pupæ of the *Ceratopogoninæ* may be readily separated from those of other chironomids by the fact that the wing cases adhere closely to the sides of the thoracic segments. The *abdomen* in all the species of the *Ceratopogoninæ* which I have examined bears upon each segment either distinct bristles (in the terrestrial forms) or protuberances (in the aquatic forms), and is of a chitinous nature, retaining its form after the emergence of the imago. In the other subfamilies the abdomen bears, at most, weak and numerous dorsal setulæ, and the whole pupal covering is of a soft nature, collapsing after the emergence of the adult. In the terrestrial forms of *Ceratopogoninæ* the pupa is not entirely withdrawn from the larval skin, those species which I have examined in this stage, and also those described by others, having the last 3–4 segments still enclosed within the larval exuvia. Pupæ of aquatic species of *Ceratopogoninæ* are free-swimming forms which, according to observations made by members of the office staff here, must make their way ashore, or to some dry surface, before the emergence of the adult. The *apex of the abdomen* in these last-mentioned forms is furcate, the branch on each side rounded in cross-section, and tapering to an acute point. This form of pupa is shown in Figure 5, Plate XVII. The apex of the abdomen in *Chironominæ* and *Tanypinæ* ends in two flattened processes which are generally fringed with hairs. These, and other pupal structures, are dealt with more fully under the different genera and species throughout this paper. In the species of *Tanypinæ* and *Chironominæ,* before the emergence of the adult the pupa rises to the surface of the water, but, unlike the species of *Ceratopogoninæ,* it is not necessary that it reach a dry surface before the emergence of the imago, which

occupies an incredibly short time, generally not more than five or six seconds.

Characters of the Imagines

In this paper I have divided the *Chironomidæ* into three subfamilies, viz., *Ceratopogoninæ, Tanypinæ,* and *Chironominæ.* In the *Ceratopogoninæ* there are, as already indicated under the two previous heads, two distinct groups. The known species of *Forcipomyia* and of *Ceratopogon,* sens. stric. of authors, have terrestrial larvæ, or larvæ which are not truly aquatic, and which have many distinct spines or bristles on the body. In imagines of this group there are generally distinct hairs on the wings, and in practically all cases the apex of the wing, at least, bears microscopic hairs. The empodium is always distinct, and generally large. The second group has, as far as is known, larvæ of a snakelike form, which are entirely aquatic, and wholly bare except at the apex of the abdomen, where four pairs of long hairs are generally present. Imagines of this second group have the wings bare, or, in *Culicoides,* with microscopic hairs, and the empodia indistinguishable or very small. In all species of *Ceratopogoninæ* examined by the writer the mouth parts are well developed, and have chitinized piercing parts, whereas in *Tanypinæ* and *Chironominæ* the mouth parts are very poorly developed and not fitted for piercing.

The species of the group *Tanypinæ* may be distinguished in the larval stage from those of *Chironominæ* by the structure of the head, which is dealt with at length in a subsequent part of this paper. In the imagines of this group the characters which most readily separate its species from those of *Chironominæ* are the 15-jointed antennæ in both sexes and the presence, near the middle of the wing, of a cross vein which connects the cubitus with the media. One section of this subfamily has the wings with surface hairs; the other section has the wings bare. The insufficiency of material in hand does not permit my forming an opinion as to whether this difference in the imagines is supported by corresponding differences in the larvæ. The imagines in *Chironominæ* are distinguished from those of *Tanypinæ* by the absence of the cross vein between the media and the cubitus and by the 8-jointed antennæ of the females, and from those in *Ceratopogoninæ* by their more slender and elongated legs and by the structure of the antenna and thorax. These distinctions are indicated in the generic key presented in this paper. The only deviation from the above rule is in the genus *Diamesa,* which has the medio-cubital cross-vein present on the wing, but the larva is essentially of the chironomid type, and the adult female has only 8 antennal joints.

Food of the Imagines

The mouth parts of the imagines of most species in *Tanypinæ* and *Chironominæ* are poorly developed, and statements have been published to the effect that in this stage they do not require food. Miall and Hammond state that the mouth is "almost closed and feeding seems to be impossible." * It is a fact, however, that in almost the whole group the mouth parts are functional; and that the many species of these groups which may be seen on flower heads during the summer, resort there to procure food is evident from their actions. It is well known that the imagines of many species in *Ceratopogoninæ* require food, as already mentioned in the introductory remarks to this paper, and the mouth parts in this subfamily are well developed. In a previous paper published by the Illinois State Laboratory of Natural History I have recorded an instance of a species, belonging to the aquatic section of this subfamily, attacking a perlid.† Walker states that the species of *Ceratopogoninæ* which have spinose femora feed upon insects,‡ but does not indicate whether he had personal knowledge of the fact, or to what particular species he referred. Gravely has recorded for a species which he refers to *Culicoides,* an instance of its sucking blood from a mosquito.§ A summary of the published records of this nature is given by Knab in the Proceedings of the Entomological Society of Washington for 1914, volume 16, page 65.

There are few published records of the food habits of other *Chironomidæ,* which is possibly due to the fact that the species are but imperfectly known and the difficulty in identifying most of them is so great that few entomologists pay any attention to the family.

ACKNOWLEDGMENTS

In the preparation of this paper I have had to examine much material belonging to genera and species which do not occur in Illinois, and to the following gentlemen my thanks are due for assistance in supplying that material: W. L. McAtee, U. S. Bureau of Biological Survey; J. M. Aldrich, U. S. Bureau of Entomology; E. T. Cresson, Jr.,

*The Harlequin Fly, p. 9.

†Bull. Ill. State. Lab. Nat. Hist., Vol. X, Art. IV, p. 216.

‡Insecta Britannica, Diptera, Vol. 3, 1856, p. 207.

§"Early in December, 1910, when some of the officers of the Indian Museum visited Port Canning, in the Sunderbunds, we found a mosquito *(Myzomyia rossi)* on one side of whose abdomen a small Chironomid fly was sitting, evidently imbibing nourishment from it. So tight was its hold that it retained its position when put into spirit, and it was successfully 'cleared' *in situ.* The proboscis of the Chironomid—which appears to belong to the genus *Culicoides*—was then seen to be well embedded in the tissues of the mosquito, removing all doubt as to the object of the association of the flies together."—Rec. Ind. Mus., Vol. 6 (1911), p. 45.

Academy of Natural Sciences, Philadelphia; and Prof. T. D. A. Cockerell, Boulder, Colo. To W. R. Walton, U. S. Bureau of Entomology, I owe thanks for assistance in various ways.

Prof. O. A. Johannsen submitted his unidentified specimens of *Ceratopogoninæ* and examples of several species described by himself, acknowledgments of which are inserted in the text. Mr. C. W. Johnson kindly examined the type of *Bezzia opaca* Loew at Cambridge, Mass., at my request, and supplied information thereon.

Keys to Subfamilies

LARVÆ

1. Abdominal segments with stout spines, generally some of them lanceolate or pectinate; both anterior and posterior pseudopods present; generally living under bark, in decaying wood, under cow manure, or in the nests of *Hymenoptera*, rarely on submerged logs ..... *Ceratopogoninæ*, pt.
— Abdominal segments usually bare, at most with weak hairs; pseudopods present or absent; aquatic in habit 2
2. Both anterior and posterior (thoracic and anal) pseudopods absent; snakelike larvæ ..... *Ceratopogoninæ*, pt.
— Both pairs of pseudopods present 3
3. Labial plate generally retracted, elongate in form, the apex slightly dilated and with 7 teeth or less; antennæ elongate, retractile within the head for almost their entire length; head generally elongated; ventral blood-gills never present ..... *Tanypinæ*.
— Labial plate never retracted, its position always beneath the labial papillæ, the apex with generally more than 7 teeth, or if the apex is narrowed the teeth are carried, more or less distinctly, along the lateral margins, and the sides diverge posteriorly, so that the apex never presents a spatulate appearance; head generally about equal in breadth and length; antennæ not retractile; ventral blood-gills sometimes present in *Chironomus* ..... *Chironominæ*.

PUPÆ

1. Thorax and abdomen with long spinelike processes on dorsum; body enclosed on last 2–3 segments within the larval exuvia; terrestrial forms ..... *Ceratopogoninæ*, pt.
— Thorax without spinelike processes; body generally entirely freed from the larval exuvia; aquatic forms 2
2. Abdomen with leaflike or spinose dorsal processes; wing cases adherent to sides of thorax; the skin chitinous, retaining its form after emergence of the adult; last segment of the abdomen ending in two rounded, tapering processes which are not ciliated ..... *Ceratogoponinæ*, pt.

— Abdomen with, at most, groups of setulæ on the dorsum; wing cases distinctly separated from sides of thorax, flaplike; the skin not chitinous, collapsing after emergence of adult; last segment of abdomen generally ending in two flattened leaflike organs which are usually ciliated along their edges.....3

3. Thoracic respiratory organs consisting of two or three main stems terminating in many threadlike filaments.....*Chironominæ,* pt.

— Thoracic respiratory organs consisting of one simple stem which is diversely shaped in the different species.....4

4. Thoracic segments much distended, thoracic respiratory organs situated well forward and generally swollen; abdomen flattened, resembling the pupæ of *Corethrinæ*.....*Tanypinæ.*

— Thoracic segments slightly distended; thoracic respiratory organs situated well forward, but generally elongated; abdomen rounded, resembling the ordinary form in *Chironomus*..*Chironominæ,* pt.

IMAGINES

1. Thorax not projecting over head, sternopleura not particularly enlarged nor descending much below apices of fore coxæ; antennæ in both sexes with 15 joints; medio-cubital cross vein absent; media with 2 branches; proboscis heavily chitinized.....*Ceratopogoninæ.*

— Thorax distinctly projecting over head; sternopleura much enlarged and descending considerably below apices of fore coxæ; antennæ either with 15 joints in both sexes *(Tanypinæ)* or the female with 8 or less *(Chironominæ)*; medio-cubital cross vein present or absent; media simple or with 2 branches; proboscis fleshy, not chitinized 2

2. Medio-cubital cross vein present; antennæ in both sexes with 15 joints .....*Tanypinæ.*

— Medio-cubital cross vein absent, or if that vein is present the antenna of the female with at most 8 joints.....*Chironominæ.*

CERATOPOGONINÆ

Larval Characters

The larvæ of the terrestrial and semiaquatic forms of this subfamily are readily separated from those of any other genus in the family *Chironomidæ* by the presence of very distinct, regularly arranged bristles on the thoracic and abdominal segments. In many instances some of these bristles are lanceolate, or at times branched, and their arrangement is invariably the same in the individuals of a species, while different species are, as far as now known, distinct in the disposition of the bristles. The antennæ are distinct, not retractile (Pl. XVIII, Fig. 15), the mandibles are distinctly toothed, the teeth generally three in

number. Both thoracic and anal pseudopods are present and well developed, both pairs being armed with two circles of claws, those in the apical circle being different in shape, and sometimes in color, from those of the subapical circle. There are no protruded dorsal respiratory organs such as are present in the aquatic forms in *Tanypinæ* and *Chironominæ*. The true aquatic forms in this subfamily are easily distinguished from those of the other subfamilies by their snakelike appearance. The pseudopods are absent, and there are no hairs on the body except at the anal end, where there are generally four pairs, which are probably sensory in nature. The head is elongate, subconical, in shape; the antennæ are very small and rather rudimentary, apparently consisting of two joints; the mandibles have a slight protuberance on the inner surface near the middle, but no distinct teeth; and the labium is very simple in form and without teeth on its anterior margin.

In transforming to the pupal stage the terrestrial forms do not entirely free themselves from the larval exuviæ, the three or four apical segments of the abdomen generally remaining within the skin; but the aquatic pupæ are invariably freed from the exuviæ.

Pupal Characters

The pupæ of the terrestrial forms may be readily separated from any other *Chironomidæ* by their distinct spinose armature. The thorax has usually several bristles on the dorsum, while the abdominal segments are invariably similarly armed. The wing cases are slightly separated apically from the sides of the body in some species, but not so distinctly as in the other subfamilies, while in others they are very closely pressed against its side. The last abdominal segment ends in two elongate, conical unfringed processes. The pupæ of the aquatic forms present quite a striking contrast to their snakelike larvæ, since all the species as far as recorded have the abdominal segments conspicuously tuberculate, or with small leaflike appendages, as shown in Figure 5, Plate XVII. The thoracic respiratory organs are trumpet- or tube-shaped and rather conspicuous. The last abdominal segment is furcate, as in the terrestrial forms, but the branches are divergent instead of parallel. From observations made by Mr. C. A. Hart and the writer it appears that the pupæ of the aquatic species are obliged to leave the water to permit the emergence of the imago, and are able to make their way over sand, or other surface, to obtain a solid location for this purpose. During a field trip in April, 1914, which included visits to various rivers at points in the southern half of the state, Mr. Hart and the author found in nearly all these localities large numbers of pupæ of these aquatic forms floating on the surface of the rivers.

At Rattlesnake Ferry, on the Big Muddy River near Grand Tower, the pupæ were very common, and from a log which was floating in the stream, many specimens were obtained by the simple expedient of immersing the exposed portion of the log, when the pupæ immediately floated off and were readily seen and captured in the water. Many pupæ were also obtained from the surface of a box moored in the river, some specimens being several inches above the water-level. In cases where the author has reared the species it has been observed that the pupæ had no difficulty in making their way up the side of the vials or bottles in which they were kept, and no imago has yet been observed emerging from a pupa which was not at least partly clear of the water. It may be mentioned, however, that in the case of *Culicoides varipennis* Coquillett no observations were possible owing to the absence of the author on field work at the time of the emergence of the adult. Several specimens of *Palpomyia longipennis* Loew have been reared in vials in this office, and in all cases the pupæ have remained partly submerged in the water at the time of emergence of the imago. It is possible that the surface of the glass proved too slippery for this species, though it presented no difficulty to large numbers of pupæ of *Johannseniomyia candelli* Coquillett and *J. flavidula* Malloch.

Imaginal Characters

The antennæ in both sexes in this subfamily are 15-jointed, the last three to five joints in most species being very distinctly elongated; in the male the antennal plumes are long and numerous, in the female short and sparse. Proboscis in most species well developed in the females, less developed in the males; palpi with four or five joints. Thorax and abdomen in some species with long more or less scalelike hairs, in others with only a few short fine hairs; hypopygium as in Figures 2 and 7, Plate XIX. Thorax not protruding over head. Legs rather stout, not elongated, their surfaces in some genera with conspicuous hairs, in others with short black thorns on the ventral surfaces of some or all of the femora, or almost bare; empodium present or absent; tarsal claws short and equal, or elongated and subequal, or unequal in length. Wings either with surface hairs, or bare; venation as in Figures 1–12, Plate XXII.

The keys here given for species of this subfamily include larvæ and pupæ of those species which have been described from North America. Owing to the rather unsatisfactory descriptions of the imagines of most species described from the same area, and to the fact that but few of them occur in the collection before me I have not attempted to give complete keys for imagines of the species of *Cera-*

topogon, Culicoides, or *Forcipomyia*. The probability is that a large number of species belonging to these genera occur in Illinois, but their small size, coupled with the difficulty in preserving and identifying them, deters most entomologists from collecting them, and with only the material recently collected by Mr. Hart and myself before me I do not consider it advisable to attempt making keys to these genera that might serve for the identification of all the described North American species.

Keys to Genera

LARVÆ

All segments with distinct bristles; pseudopods present..... .....*Ceratopogon* and *Forcipomyia*.
All segments without bristles; pseudopods absent..... .....*Culicoides, and Palpomyia, sens. lat.*

PUPÆ

Thorax and abdomen with distinct bristles or spines..... .....*Culicoides, Ceratopogon*, and *Forcipomyia*.
Thorax without any spines, abdomen with tuberculate or leaflike protuberances on segments.....*Palpomyia*, sens. lat.

IMAGINES

1. Wings with distinct surface hairs, either in the form of short, upright microscopic setulæ or as broad decumbent scales.....2
— Wings bare 5
2. Thorax with a distinct slitlike or circular depression on each side of disc slightly posterior to the inner extremity of prescutum..... .....*Culicoides* (p. 295).
— Thorax without these depressions.....3
3. Wings with distinct decumbent scales on entire surface.....4
— Wings with short, upright setulose hairs which are usually confined to apical half; empodium large.....*Ceratopogon* (p. 304).
4. Hairs on wings rather sparse, basal joint of hind tarsus twice the length of second; apical 4 antennal joints of male elongated and, except the last one, binodose.....*Pseudoculicoides* (p. 309).
— Hairs on wings very dense, particularly in females; basal joint of hind tarsus not, or very slightly, longer than second; apical 3–4 antennal joints of male elongated, not binodose. ....*Forcipomyia* (p. 311).
5. First and third veins connected by a cross vein or fused basally...6
— First and third veins disconnected for their entire length.....10
6. At least one pair of femora with distinct ventral spines.....7
— Femora without ventral spines.....9

7. Generally more than one pair of femora with spines; neither fore nor hind femora noticeably thickened.....*Palpomyia* (p. 319).
— Only fore or hind femora with spines, the spinose pair perceptibly thickened 8
8. Fore femora thickened and spinose.....*Heteromyia* (p. 324).
— Hind femora much thickened and spinose....*Serromyia* (p. 331).
9. Media sessile .....*Johannsenomyia* (p. 332).
— Media petiolate .....*Hartomyia* (p. 339).
10. At least one pair of femora with ventral spines.....11
— Femora not spinose.....12
11. Media sessile .....*Bezzia* (p. 345).
— Media petiolate .....*Pseudobezzia* (p. 351).
12. Media sessile .....*Probezzia* (p. 352).
— Media petiolate .....*Parabezzia* (p. 358).

N. B. The genus *Atrichopogon* is distinguished by the bare wings and distinct empodia. I have seen no species belonging to this genus.

Keys to Larvæ and Pupæ of North American Species of Ceratopogon and Forcipomyia*

LARVÆ

1. Body slightly flattened, deep lateral incisions between the abdominal segments, each segment with a lateral, pointed elongation, as shown in Figure 4, Plate XVII, body bristles simple, neither lanceolate nor branched .....*C. fusculus.*
— Body rounded, in cross-section, incisions between the segments not deep, body bristles not all simple.....2
2. Dorsal bristle and the anterior one of the dorso-lateral pair thickened at base, tapering to well beyond the middle.....
.....*F. stenammatus.**
— Dorsal bristle spear- or club-shaped, thicker beyond middle than at base 3
3. One dorso-lateral bristle, the usual posterior dorso-lateral one being on a horizontal level with the lateral bristle, so that there may be said to be 2 lateral bristles.....*F. brumalis.**
F. cilipes.
— Two dorso-lateral bristles present, situated on a distinct ridgelike prominence, lateral bristle much below the level of both.....4.
4. Dorsal bristles very short and leaflike.....*F. wheeleri.**
— Dorsal bristles elongated, at least six times as long as their greatest breadth 5
5. Dorsal bristle club-shaped, or spatulate, the broadest part beyond middle 6
— Dorsal bristle spear-shaped, its broadest part slightly before the middle (Pl. XVIII, Fig. 17).....*F. specularis.*

*Species marked with an asterisk are unknown to me except by description.

6. Dorsal bristle with apical part rounded.....*F. texanus.**
— Dorsal bristle with apex pointed.....*F. pergandei.*

PUPÆ

1. Thoracic respiratory organs shoe-shaped.....*C. fusculus.*
— Thoracic respiratory organs drumstick-like.....2
2. Abdomen with a pair of spines on segments 2 to 4, those on the latter much shorter than the other pairs.....*F. whecleri.**
— All the segments which are exposed beyond the larval exuvia with spines, which are not limited to one pair on each segment.....3
3. Bristles on abdomen very short and inconspicuous; no spine on head ..... { *F. brumalis.** / *F. cilipes.*
— At least some of the bristles on abdomen long and conspicuous....4
4. A distinct spine present on either side of head.....5
— Head without a distinct spine.....*F. stenammatus.**
5. Dorsal and dorso-lateral abdominal bristles very unequal in size; ventral surface of abdominal segments 3–5 with a short spine at middle .....*F. specularis.*
— Dorsal and dorso-lateral abdominal bristles not noticeably different in size; no ventral spine present.....*F. pergandei.*

Culicoides Latreille

Culicoides has generally been distinguished from *Ceratopogon,* in the restricted sense, by the small size of the empodia as compared with the size of the tarsal claws. In no species which I have retained in *Culicoides* have I found distinct empodia, and but for the fact that my material is rather scanty I should not hesitate to indicate their absence as a character for distinguishing the genus. I have, however, found a character by which the genus may readily be separated from its allies, which is both easily appreciable and of real phylogenetic value. This character is the presence, on the anterior portion of the thoracic disc, of a pair of distinct cavities or depressed areas (Pl. XXIII, Figs. 1–3) which I believe are sensory organs of some functional value to the species. These cavities are remarkably conspicuous in all species having the disc of the thorax gray pruinose, and are very easily detected even with a low-power lens. I have dissected several species in an unsuccessful effort to discover whether they are connected with tracheæ. I have, however, established the fact that the surface of the oval or slitlike cavity is either finely perforated or has many minute areas of extremely thin membrane, which fact seems to justify the opinion that they are functional. Most of the species of *Culicoides* which I have seen have, like *pulicaris* Linné, spotted wings,

the surface hairs very minute and erect, and the basal joint of the tarsi much longer than the second. In two species described herewith the wings are unspotted.

The larvæ are aquatic in habit, and as far as known all of the species are bloodsuckers in the adult stage.

KEY TO SPECIES IN STATE LABORATORY COLLECTION

1. Wings clear, entirely unspotted.....2
— Wings distinctly spotted.....3
2. Mesonotum with numerous small brown dots arranged in irregular longitudinal series .....1. *multipunctatus.*
Mesonotum with a few large brown marks (Pl. XXIII, Fig. 3) .....2. *hieroglyphicus.*
3. Mesonotum with numerous small brown dots arranged in irregular longitudinal series; wing as in Figure 2, Plate XXII.....3. *varipennis.*
— Mesonotum with large brown marks on a grayish brown ground, or whitish pruinescent marks on a brown ground.....4
4. Mesonotum marked with white as in Figure 1, Plate XXIII.....5
— Mesonotum either indistinctly marked or with dark brown marks..6
5. Anterior branch of media with a white spot close to base (Pl. XXII, Fig. 4) .....4. *guttipennis.*
— Anterior branch of media without white spot near base.....5. *stellifer.*
6. Spots on wings indistinct (Pl. XXII, Fig. 3); mesonotum without well-defined marks; hypopygium as in Figure 18, Plate XX.....6. *sanguisugus.*
— Spots on wings clearly defined; mesonotum with well-defined brown marks 7
7. Wings with the clear spots rather small, the spot beyond the one at apex of third vein situated at the apex of anterior branch of media, and like the outer one in the second and third posterior cells touching the margin of the wing (Pl. XXII, Fig. 6).....7. *hæmatopotus.*
— Wings with the clear spots large, the spot beyond the one at apex of third vein situated distinctly before apex of first posterior cell, the outer spot in second and third posterior cells separated from margin of wing (Pl. XXII, Fig. 7).....8. *crepuscularis.*

1. CULICOIDES MULTIPUNCTATUS, n. sp.

Female.—Opaque gray. Head brownish; antennæ and palpi pale brown, the former yellowish towards base. Thorax densely covered with gray pruinescence, the disc of mesonotum with numerous small brown dots arranged in three longitudinal series, the median one consisting of three rows of regularly rounded small dots which are dis-

continued at middle of disc—being represented on the flattened posterior half by a few scattered dots—and a row of confluent dots on either side of this median series, forming a narrow line which skirts the depressed posterior area laterally, and there are also, between this line and the lateral margin, many irregularly arranged dots, some isolated and others forming confluent groups; scutellum brown. Abdomen opaque brown, the surface with slight gray pruinescence. Legs obscurely yellowish, with ill-defined brownish suffusion on femora and tibiæ. Wings clear, costal, first, and third veins brown, the others vitreous. Halteres yellowish white.

Eyes separated; antenna longer than head and thorax together, apical five joints slightly elongated; antepenultimate joint of palpi much swollen. Disc of mesonotum with short yellow hairs, each situated in one of the brown dots; scutellum with about 6 hairs. Legs normal in strength and armature. Third vein ends slightly beyond middle of wing, its apex and apex of costa swollen; first vein very close to third, the connecting vein broad; in other respects, except the maculation, as *sanguisugus*.

Length, 1 mm.

Type locality, Urbana, Ill., October 2–3, 1914, at light (C. A. Hart and J. R. Malloch).

2. Culicoides hieroglyphicus, n. sp.

Female.—Differs from *multipunctatus* in the thoracic ornamentation. The disc of the thorax is marked with large brown spots, as shown in Figure 3, Plate XXIII, and much resembles in this respect *crepuscularis*, from which the entirely unspotted wings readily separate it.

The eyes are very narrowly separated. In other respects the species agrees closely in structure with *multipunctatus*.

Length, 1–1.25 mm.

Type locality, Ash Creek, Graham Mountain, Arizona, altitude 3200 feet, May 30, 1914 (E. G. Holt). Type in collection of U. S. Bureau of Biological Survey. Paratypes in collection of this Laboratory.

3. Culicoides varipennis Coquillett

Ceratopogon varipennis Coquillett, Proc. U. S. Nat. Mus., 1902, Vol. 25, p. 94.

Larva.—Not described. Aquatic. Vermiform.

Pupa.—Length, 3.5 mm. Brownish yellow. Thoracic respiratory organs long and slender, their length at least equal to distance from anterior extremity of head to wing-base, shaped as in Figure 17, Plate

XX, 6 small circular spots at apices evidently indicate breathing apertures, apical portion distinctly geniculated to the elongate base; 2 pairs of short thornlike tubercles anterior to respiratory organ, and 2 smaller closely placed pairs on middle of thorax (Fig. 11); abdominal segments with distinct tubercles situated as shown in Figures 11 and 12; apical segment as in Figure 13.

Imago; Male.—Black, densely covered with gray pruinescence. Head black; antennae brown, the plumes yellow. Disc of mesonotum with numerous small dark brown dots arranged as follows—a straight median line of small ones, a submedian row on either side consisting of irregularly placed subconfluent groups of from 2 to 4, the area on which they occur broadening and the spots becoming more sparse posteriorly; bordering this area there is a regular line of smaller dots similar to the median line, and on the lateral margins numerous slightly larger dots, those near the middle being surrounded by a brownish suffusion; scutellum yellow, centrally with a broad brown mark. Abdomen dull black. Legs brown, marked with pale yellowish white bands as follows—fore femora, at base, middle, and near apex, and all tibiæ near their bases; bases of mid and hind femora and apices of all tarsi broadly pale. Wings as in Figure 2, Plate XXII. Halteres brown, the apices of knobs broadly pale.

Eyes narrowly separated, antennæ with the basal joint globose, only the last three joints much elongated (Pl. XX, Fig. 8), entire length of antenna equal to one and a fourth that of head and thorax combined. The brown spots on disc of mesonotum each with a distinct hair; scutellum with sparse short hairs. Abdomen slender, the surface hairs short and fine; hypopygium as in Figure 6. Legs slender, surface hairs on mid and hind tibiæ longer than on other portions; basal joint of hind tarsi as long as the combined length of the remaining joints; fourth joint about half as long as fifth; claws small, the base slightly produced (Pl. XX, Fig. 15).

Female.—Differs from the male in being rather more robust, in having the antennæ about equal in length to the head and thorax together, third joint of flagellum as in Figure 14, Plate XX. In other respects as the male.

Length, 2–2.5 mm.

Illinois localities: St. Joseph, Urbana, Dubois, Ashley, Carmi, Cuba, Centralia, Manchester, and Normal. All the specimens I have before me were taken in April and May with the exception of one male which I beat from an evergreen tree at Manchester, July 11, 1914.

The St. Joseph record refers to a larva which the writer obtained from Salt Fork and which he succeeded in rearing. The larval skin

was lost, but the pupa was preserved and the accompanying drawings were made from the specimen.

This species belongs to the same group as *pulicaris* Linné of Europe, and is a persistent biter. On April 15, 1914, the writer was bitten by this species at Carmi, on the Little Wabash River. It was in the afternoon, contrary to the general custom of these species, as they generally fly in the evening, and the red spot produced by the bite was noticeable for at least five hours. The species is larger than *pulicaris*, and the bite more severe, as the writer can testify from his own experience.

At Dubois both sexes of *varipennis* were beaten from an evergreen plant—a favorite resting place for most of the species according to the writer's knowledge of their habits both here and in Europe—and subsequently a large series of females was taken on a horse which was left in the yard for a short time. It was early in the afternoon when these were taken, but immediately after a slight shower and when the sun was not shining. All were taken on the lee side of the horse, but whether they approached from that direction was not ascertained. An examination of some cows which had just come in from the fields produced a few specimens, mostly attached to the tender parts close to the upper extremities of the legs. It was somewhat difficult to detach the flies, as they bore well amongst the hair and retain their hold very firmly. While many specimens of this species were obtained from the horse when it was near the house, only one was taken from it when it was in the woods a mile or so from the house. There, the species most common was *sanguisugus* Coquillett, the habits of which are mentioned in the notes on that species (pp. 301–302).

Two males and one female were taken at light at Mr. Hinkley's farm, Dubois, April 24, 1914.

Varipennis was described by Coquillett from specimens obtained at Las Vegas Hot Springs, N. M. I have examined specimens of this species in the collection of the U. S. Bureau of Biological Survey taken on Graham Mountain, Arizona, in May and June, 1914, some of them at an altitude of 3200 feet.

4. Culicoides guttipennis Coquillett

Ceratopogon guttipennis Coquillett, Proc. U. S. Nat. Mus., 1901, Vol. 23, p. 603.

Female.—Blackish brown, subopaque. Head blackish brown, base of flagellum of antennæ pale brown. Mesonotum with whitish pruinescence forming the following marks: a pair of central vittæ on the anterior half which are indistinctly connected with a pair of large spots posteriorly, the latter dilated anteriorly, and each with a small enclosed black area; reaching to posterior margin, laterad of these

marks, there is a row of three spots, the posterior one on posterior lateral angle of disc, the second slightly beyond middle, and the anterior one in transverse line with the posterior extremity of the distinct portion of the central vittæ; in transverse line with the second spot and slightly laterad of it there is a similar spot, and anterior to it and in transverse line with the space between the second and anterior spots of the inner row there is another; anterior and lateral margins also with distinct pruinescence; scutellum with a whitish pruinose spot on each side (Pl. XXIII, Fig. 1). Abdomen with indications of a lateral series of black spots, one on each segment. Legs brown, mid and hind femora with a narrow subapical ring, all tibiæ with a basal ring, the apices of mid and hind tibiæ, and the tarsi mostly yellowish. Wings as in Figure 4, Plate XXII. Halteres pale yellow.

Eyes contiguous; antennæ slender, basal eight joints of flagellum distinctly longer than their diameter (2 : 1), sensory hairs about one and a half times as long as the joints, whitish, apical five joints much elongated, ninth more than twice as long as eighth, apical joint slightly swollen and about one fourth longer than subapical, entire length of antenna nearly twice that of head and thorax combined; antepenultimate segment of palpi much as in *sanguisugus*. Mesonotum with sparse pale discal hairs, and a few longer black bristles on margins and on spaces between the vittæ and the submedian row of spots; scutellum with about 6 long and a few short hairs. Legs slender, hind tibiæ and basal joint of hind tarsi with long hairs; basal joint of hind tarsi as long as the next three combined; fifth joint about one and a half times as long as fourth; empodium indistinguishable; claws small, equal, about half as long as fifth joint, untoothed.

Length, 1.5 mm.

Illinois locality, Dubois, April 27, 1914. Taken with *sanguisugus* on a horse by the writer. One specimen.

Originally described from specimens obtained at Medina, Ohio.

Early stages undescribed.

5. Culicoides stellifer Coquillett

Ceratopogon stellifer Coquillett, Proc. U. S. Nat. Mus., 1901, Vol. 23, p. 603.

Male.—Similar to *guttipennis* in general markings. The white pruinose marks on the thorax are upon the same lines but comparatively larger and more generally confluent. Legs yellow, with brown bands on middle of femora, on knees, beyond base of tibiæ, on apices of tibiæ, and at bases of tarsi. Wing-markings as in Figure 5, Plate XXII.

Antenna one and a half times as long as head and thorax together. Mesonotum with a few brown hairs on anterior and lateral margins; scutellar hairs setulose, sparse. Hypopygium much as in *hæmatopotus*. Legs slender, the surface hairs sparse and short. Wings narrow, the surface with distinct though minute hairs.

Female.—Similar to the male except that the wing markings are more sharply defined and the clear spots much smaller, with a tendency to have the small spot at apex of first posterior cell indistinct or absent, and the resemblance to *guttipennis* in wing-markings more pronounced though the white spot near base of anterior branch of media is always absent.

Length, 1–1.25 mm.

Illinois locality, Urbana, Ill., June 6-19, 1914. Taken on window in Natural History Building, University of Illinois (J. R. Malloch).

Originally described by Coquillett from the District of Columbia, I have before me a female specimen taken at light at South Haven, Mich., July 15, 1914, by Mr. Hart.

6. Culicoides sanguisugus Coquillett

Ceratopogon sanguisuga Coquillett, Proc. U. S. Nat. Mus., 1901, Vol. 23, p. 604.

The early stages of this species are unknown to the writer, but one is reasonably safe in assuming the larva to be aquatic in habit.

Male.—Blackish brown, subopaque. Head black, antennæ yellowish on basal half of flagellum, the plumes yellow. Anterior lateral angles of mesonotum pale brown; disc with grayish pruinescence, a small black spot near to anterior margin and lateral angle, a narrow indistinct central stripe which is almost connected with two elongate spots at middle, and two elongate submedian spots which do not extend to either anterior or posterior margins; scutellum black. Abdomen blackish brown. Legs varying from brown to yellow, without defined pale or dark markings. Wings as in female (Pl. XXII, Fig. 3).

Eyes contiguous; antenna one and a half times as long as head and thorax combined, apical four joints as in Figure 4, Plate XX. Mesonotum rather weakly and sparsely haired. Hypopygium as in Figure 18. Legs slender, the surfaces with moderately long hairs; basal joint of hind tarsus as long as the next two joints combined; fourth and fifth subequal; claws swollen at base, equal, half as long as fifth joint.

Female.—Differs from the male in being rather smaller and more robust; in having antennæ about one fourth longer than the head and thorax combined, the first eight joints of flagellum subequal in length, shape as in Figure 9, Plate XX, the last five gradually increasing in

length to apex, the apical joint being distinctly the longest; palpus as in Figure 10. In other respects similar to the male.

Length, 1.25–1.75 mm.

Illinois localities: St. Joseph, Urbana, Carbondale, Dubois, Grand Tower—April, May, October, and November 29.

Originally described from Marlboro, Md., and recorded as biting man.

At Dubois this species was found in company with *varipennis* harboring in evergreens during the day, and attacking a horse in the woods. Mr. C. A. Hart was bitten on the hand by this species at his house in Urbana, and several examples were taken at light at the same place. Large numbers of specimens of both sexes were taken at light on store windows in Urbana in October, 1914, by Mr. Hart and the writer.

A species submitted by Prof. J. J. F. X. King, from Scotland, is very close to, if not identical with *sanguisugus*.

7. Culicoides hæmatopotus, n. sp.

Male.—As to marking of thorax this species differs from *crepuscularis* in having the central vitta less clearly defined, especially on the dilated posterior portion, in having the submedian spots on posterior half of disc larger, and in having the lateral irregular spot on anterior half carried well over the thoracic cavity backward from the latter to meet the elongate curved spot, and at its lateral extremity distinctly connecting with it, leaving only a small rounded spot of the pale pruinescence. The pale preapical bands on femora and subbasal band on tibiæ are generally quite distinct. Wings as in Figure 6, Plate XXII.

Structurally, very closely resembles *crepuscularis*. Antennal joints 12–15 as in Figure 5, Plate XX. Hypopygium as in Figure 3. Basal joint of hind tarsus slightly longer than the next two joints combined; fifth joint one half longer than fourth; claws as in *varipennis*.

Female.—Similar in coloration to the male.

Eyes narrowly separated; antenna about a third longer than head and thorax combined, apical three joints elongated. Abdomen stouter than in the male, and the wings broader and more distinctly spotted. Otherwise as male.

Length, 1–1.5 mm.

Type locality, Urbana, Ill., May 24, 1914. Taken by the writer at light (male) and in the act of biting hands (female). Several other females were taken at light at same time, the place being the center of the city. A single paratype was taken by the writer June 30 on a win-

dow of the Laboratory of Natural History at Urbana, and one was captured at Muncie, Ill., May 24, 1914, on the bank of Stony Creek. Male paratype on slide—Canada balsam.

Nothing is known of the early stages.

Hæmatopotus and *crepuscularis* are closely related to *stellifer* Coquillett, but may be separated from it by the wing and thoracic markings. The sketches given herewith (Pl. XXII, Figs. 6, 7) represent the normal markings of the wings of *hæmatopotus* and *crepuscularis*, but occasionally the spot in the fourth posterior cell is larger, and the upper half dilated on the inner side, giving it the appearance of two coalescent spots, while the spot at apex of the anal cell is sometimes distinctly divided at the middle.

C. phlebotomus Williston is closely related to *hæmatopotus* and *crepuscularis*, differing slightly in wing markings and in color of abdomen and legs. *Phlebotomus* occurs in St. Vincent, West Indies, and is said to be "the common 'sand-fly' about the southern end of the island, but is not very troublesome. Bites late in the afternoon, before sunset; sometimes during the heat of the day."—*Williston.*

8. Culicoides crepuscularis, n. sp.

Male.—Blackish brown, opaque. Head black, basal half of antennal flagellum pale brownish yellow, plumes yellowish, the short hairs on apical antennal joints white; palpi brown. Mesonotum covered with dense yellowish gray pruinescence, and marked with brown as follows: a central vitta on anterior half which generally assumes a diamond shape posteriorly, an elongate spot on each side of the median line on posterior half which does not reach posterior margin and falls short of the transverse line of the apex of central vitta, a small spot on center of posterior margin, an elongate lateral spot which is dilated laterad at both extremities, the center of which is in transverse line with the space between the apex of central vitta and anterior extremity of submedian spot, a large irregularly shaped spot which extends from the depressed area nearly to the wing-base, close along the lateral margin, being generally connected with the curved spot at the anterior extremity of the submedian spot by a very fine line, and a pair of spots on the anterior margin which generally connect with the central vitta at its anterior extremity; scutellum with a brown central spot (Pl. XXIII, Fig. 2). Abdomen opaque blackish brown, the depressions on segments glossy. Legs varying from yellowish to dark brown, generally with a paler preapical band on femora and one on bases of tibiæ, and the tarsi yellowish. Wings as in Figure 7, Plate XXII. Halteres yellow, knob white.

Eyes contiguous; antenna about one third longer than head and thorax combined, only the apical three joints distinctly elongated, as in Figure 7, Plate XX. Hairs on mesonotum short. Hypopygium as in Figure 16, Plate XX. Legs slender; hind tibiæ with rather long hairs; basal joint of hind tarsi as long as the next three joints combined; fourth over two thirds as long as fifth; claws simple, short, not more than half as long as fifth joint.

Female.—Agrees with male in color. Eyes narrowly separated; antenna about one third longer than head and thorax combined, the last five joints elongated, the apical three slightly more elongated than the two preceding, sensory hairs curved, as long as the joints; the enlarged palpal joint with its thickest part at middle, rather oviform, the last two joints very short and closely fused. Otherwise as the male except that the wings are, as usual, much broader and more distinctly spotted.

Length, 1.5 mm.

Type locality, Dubois, Ill., April 24, 1914, male. Allotypes from Urbana, May 18–24 and October 9, the last two dates at light; and from St. Joseph, May 3, 1914. Specimens taken by Chas. A. Hart and the writer. Paratypes and allotype from South Haven, Mich., July 15, 1914, at light (C. A. Hart). These latter specimens as compared with the Illinois specimens, have the thoracic markings reduced slightly and paler in color. A single paratype is in the collection of the U. S. Bureau of Biological Survey, from Graham Mt., Arizona, 3200 feet, May 30, 1914.

Ceratopogon Meigen

The species of *Ceratopogon,* in the restricted sense, are not numerous in Illinois, but two of the species are very widely distributed and common. The larva of one species only is known to me. Nothing is known of the habits of the Illinois species in the adult stage. Johannsen has described *eques,* which either belongs to this genus or to *Pseudoculicoides,* and records it as attacking a bat.* The present writer has usually been able to obtain adult specimens by sweeping vegetation near to streams, and many have been taken on windows of houses in the daytime or on store windows at night, after the lights were turned on.

Key to Illinois Species

1. Scutellum yellow, contrasting with the much darker color of the mesonotum 2
— Scutellum brown or black, concolorous with disc of mesonotum...3

*Bull. 124, N. Y. State Mus., 1908, p. 266.

2. Larger species, 1.75–2 mm.; anterior lateral angles of mesonotum inconspicuously or not at all yellow in female; antennæ with second joint and basal joint of flagellum yellow in female, only the apical 3 joints in male conspicuously elongated.....1. *fusculus.*
— Smaller species, 1–1.5 mm.; anterior lateral angles of mesonotum in female generally broadly yellow, and occasionally a patch of yellow in front of scutellum also; antennæ with base fuscous in female, the apical 4 joints in male conspicuously elongated..2. *levis.*
3. Wing with first vein almost fused with third, not quite reaching middle of third; antepenultimate joint of antenna in male about a third longer than preceding joint (15 : 11).....3. *fusinervis.*
— Wing with first vein distinctly separated from third, connected with it by a cross vein and less than a third the length of third; antepenultimate joint of antenna in male nearly twice as long as preceding joint (17 : 9).....4. *peregrinus.*

Comparative Lengths of Apical four Antennal Joints of Males.*

Species	Antennal joints			
	12th	13th	14th	15th
C. fusculus	8	35	26	27
C. levis	12	19	15	21
C. fusinervis	11	15	14	18
C. pergrinus	9	17	15	21

*The measurements are comparative, and were made with a compound microscope fitted with a ¼ in. objective and a No. 4 Bausch and Lomb eyepiece. The scale, divided into tenths of a millimeter, fitted to eyepiece.

1. Ceratopogon fusculus Coquillett

Ceratopogon fusculus Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 605.

Larva.—Length, 2.5–3 mm. Yellowish, the dorsum covered with minute black spinules causing the surface to appear brown. Antennæ prominent, though not longer than half the width of head, borne upon slightly raised bases, and apparently consisting of two joints, the basal joint thick and slightly more than half the length of the apical one, the latter at base barely more than half as thick as basal joint, slightly tapering to apex; eye spot distinct; mandible with three distinct teeth, somewhat similar to those of *Forcipomyia specularis* but more distinctly rounded apically. Dorsal outline of larva and arrangement of bristles as shown in Figure 4, Plate XVII, the surface covered with microscopic spinules; thoracic and anal pseudopods distinct, each armed with two circles of strong hooklike claws, those of the central, or apical, series much more slender and darker than those of the outer, or subapical, series. Ventral surface with the spinules less closely placed, and without bristles except the two on the projecting lateral

portions of the segments; abdominal segments, except the last two, with two longitudinal brown lines which occupy a submedian position and converge slightly posteriorly; laterad of these on the same segments, a small rounded brown spot.

Pupa.—Length, 2.5–2.75 mm. Yellowish brown. Thoracic respiratory organ large, somewhat shoe- or boot-shaped, the apical half turned forward, lying parallel with the side of thorax but distinctly removed from its surface; arrangement of bristles on thorax as in Figure 19, Plate XVIII; anterior thoracic bristle much the same in form as the dorsal bristle of abdomen but more distinctly curved; the other thoracic bristles with their apices crowned with a weak hair. Apex of lateral abdominal bristle with a weak hair, the dorsal bristle as in Figure 1; abdominal segments three times as wide as long, armed as in Figure 7; dorsal surface granulose, a dark brown spot between the two dorsal bristles and another on each side; ventral surface smooth; a brown spot midway between the central line and lateral margin on each side of the segments; apex of pupa retained within larval exuvia.

Imago; Male.—Black, slightly shining. Head, including palpi, proboscis, and antennæ, fuscous; antenna longer than head and thorax taken together; antennal plumes blackish. Mesonotum shining black, the surface obscured by dense yellowish pruinescence; pleuræ black, not shining, with whitish pruinescence; scutellum brownish yellow. Abdomen black, shining, slightly pruinose; hypopygium brown. Legs yellow, fore and mid coxæ slightly browned. Wings clear, veins brown, Halteres white. Body bristles brown, the short hairs yellow.

Eyes contiguous; antennæ with the second joint globose, very large, last three flagellar joints much elongated, the short joints beadlike near base, but the last three or four with one side scooped out slightly, this being most distinct on last joint, as shown in Figure 6, Plate XIX; palpi (Fig. 8) with the antepenultimate joint as long as the next two combined, but little swollen. Mesonotum with 2–3 weak bristles in front of wing-base, the discal hairs weak and very sparse; scutellum with four bristles and weak discal hairs. Hypopygium as in Figure 18, Plate XXI. Wings narrow, third vein ends at almost three fourths of wing-length; first, at one third of third; media forking slightly beyond cross vein; cubitus forking at about same point.

Female.—Similar to the male in coloration, except that the second and third antennal joints, scutellum, and a small spot at anterior angles of the mesonotum are yellow.

Antenna as in Figure 1, Plate XIX, the entire length not exceeding the combined lengths of head and thorax; palpus as in male; proboscis more elongate, its length about equal to height of head. Abdomen ovate. Legs slender; surface hairs distinct but not strong; basal

joint of hind tarsi about three times as long as second; claws short, simple, equal. Wings broader than in male, venation similar but with the first vein extending nearer to middle of third (Pl. XXII, Fig. 8).

Length, 2–2.75 mm.

Illinois localities: Havana—larvæ and pupæ found on log in river and on submerged portions of wooden float, and adults taken at Chautauqua Park, April 29, 1914; St. Joseph, May 10, 1914; Monticello, June 28, 1914; Urbana, June 20, 1888, and June 6, 1914.

Originally described from specimens obtained in the District of Columbia, New Jersey, and on Mount Washington, N. H. Garman has recorded the occurrence of the larvæ in Kentucky* under circumstances similar to its occurrence in Illinois.

Nothing is known of the habits of the adults. The few specimens in the collection here were obtained by sweeping vegetation near streams.

2. Ceratopogon levis Coquillett

Ceratopogon levis Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 604.

This species varies very considerably in color. In some specimens the pale yellow is confined to the anterior lateral angles and scutellum, while in others it occupies a very large portion of the disc laterally and posteriorly. In the case of one specimen from Michigan the yellow extends across the mesonotum in front of scutellum, and anterior to this transverse line there are two detached, rounded submedian spots of yellow. In the great majority of specimens the abdomen is dark brown on the dorsum and yellowish ventrally, but in the paler forms the dark color is confined to the basal half of the dorsal segments. The thorax is always much more distinctly shining than in *fusculus,* and the length is invariably less. Second and apical joints of antennal flagellum of male as in Figures 14 and 15, Plate XXI. The third vein ends beyond two thirds the wing-length, and the first vein reaches to one third the length of third; the usual cross vein connects the first vein with third; the media forks slightly beyond the cross vein. Hypopygium as in Figure 19; last ventral segment with a single transverse row of hairs, four of which are in the area which is occupied by the group of hairs in *fusculus.*

Length, 1–1.5 mm.

Illinois localities: Havana, Muncie, White Heath, Urbana, Monticello, Mahomet, St. Joseph, Manchester, Dubois, Golconda, Cairo. Dates of occurrence range from April 18 to November 24.

Originally described by Coquillett from specimens obtained at Marlboro, Md. I have seen specimens from Ithaca, N. Y. (O. A.

*Bull. 159, Ky. Agr. Exper. Sta., 1912, p. 31, sp. 5.

Johannsen) and Little Bear Lake at Grand Junction, Mich. (C. A. Hart).

The commonest species of the genus according to my experience.

Early stages undescribed and adult habits unknown.

3. Ceratopogon fusinervis, n. sp.

Male.—Black, shining. Head entirely black; antennal plumes blackish brown. Mesonotum with slight brownish pruinescence. Abdomen less distinctly pruinescent than mesontum; apical half of lateral arms of hypopygium yellowish. Legs brownish yellow, mid and hind coxæ and the knees darkened. Wings clear, veins brown. Halteres brownish, the knobs white. Bristles on body black.

Eyes contiguous; antennæ rather stout, subequal in length to head and thorax together, apical four joints elongated, short joints of flagellum somewhat cup-shaped; antepenultimate joint of palpi not as long as apical two joints together and hardly thicker than ultimate joint. Mesonotum without distinct hairs except on posterior half, lateral view of anterior half as in Figure 6, Plate XXIII; scutellum with four marginal bristles. Hypopygium as in Figure 20, Plate XXI. Legs rather stout; basal joint of hind tarsi a little more than twice as long as second; claws small, simple, equal. Third vein ends at two thirds the wing-length, first almost fused with third, reaching to middle of latter; petiole of media very short; cubitus forking below end of first vein.

Female.—Similar to male in coloration.

Eyes separated by a very narrow line; antennæ rather thick, apical five joints elongated, entire length of antenna equal to head and thorax combined. Thorax and abdomen more robust than in the male, the hairs on the former more distinct. Legs similar to those of the male. Wings broader, venation similar to that of the male.

Length, 1–1.5 mm.

Type locality, Grand Tower, Ill., April 21, 1914, on bank of Mississippi River (C. A. Hart and J. R. Malloch). Paratypes taken by the same collectors at St. Joseph, May 3, Urbana, May 20, Havana, May 2, Dubois, April 24, and Monticello, June 28, all in 1914.

4. Ceratopogon peregrinus Johannsen

Ceratopogon peregrinus Johannsen, Bull. 124, N. Y. State Museum, 1908, p. 266.

Very similar to *fusinervis*, but differing from it in the male in structure of antennæ and in form of hypopygium, the apical portion of the lateral arm of the latter being much shorter and stouter, resembling

that of *levis* though lacking the stout hairs on the outer side of this arm in that species and having the hairs on the inner side more distinct. The female differs from *fusinervis* principally in venation, the first vein being distinctly short of the middle of third, and entirely separate from it except where it is connected by the cross vein. The color of the female is also slightly different from that of *fusinervis*, the abdomen in *peregrinus* being generally brown.

Length, 1–1.25 mm.

Illinois localities: Urbana, Mahomet, Monticello, Muncie, St. Joseph, Sumner, Dubois, and Algonquin. Dates of capture range from April 24 to November 7.

Originally described from New York State. I have seen examples from Ithaca, New York, submitted by Professor Johannsen, and from South Haven and Grand Junction, Michigan, collected by Mr. Hart.

I have little doubt as to the correctness of the identification, though the species may have been described by Coquillett under another name with which description I have failed to associate the species.

Pseudoculicoides, n. gen.

This genus is especially distinguished from *Culicoides* by the absence of thoracic cavities and by the structure of the antennæ of the male, the last four joints being elongated and, except the apical joint, binodose, each node having a distinct whorl of long hairs, the apical joint simple, swollen, and having a single whorl of hairs. The antennæ of the female are very much like those of *Culicoides*, but the apical joint is more swollen and the hairs are longer, the tarsi have distinguishable empodia, and the surface of the wings is covered with coarse decumbent hairs instead of the fine upright hairs present in *Culicoides*.

Type species, *Pseudoculicoides mutabilis* Coquillett.

Key to Species

1. Small species, at most 1.5 mm. in length 2
— Larger species, 1.75 mm. in length 3
2. Mesonotum velvety black with more or less distinct whitish pruinose markings ..... 1. *mutabilis.*
— Mesonotum black, entirely covered with dense brownish pruinescence ..... 2. *cinctus.*
3. Inferior process of hypopygium short (Pl. XXI, Fig. 9) ..... 3 *major.*
— Inferior process of hypopygium long (Pl. XXI, Fig. 10) ..... 4. *johannseni.*

1. Pseudoculicoides mutabilis Coquillett

Ceratopogon mutabilis Coquillett, Proc. U. S. Mus., 1901, Vol. 23, p. 604.

Male.—Black. Head black, antennal plumes brown-black. Mesonotum on anterior half and lateral margins with whitish pruinescence, which viewed from behind takes the form of two central vittæ which dilate laterally at middle of disc, posterior to which point the surface is shining, a very distinct pruinose patch surrounding a black spot on either anterior angle; scutellum, a small spot below wing-base, and another on anterior angle orange-yellow. Abdomen opaque black. Legs blackish brown, bases of tarsi and sometimes apices of tibiæ yellowish. Wings clear, costal and radial veins, especially at apices, black, the other veins pale; surface hairs brown. Knob of halteres white.

Antenna slightly longer than head and thorax combined, apical five joints as in Figure 2, Plate XX. Mesonotum with sparse brownish setulose hairs on margins and on spaces between the vittæ; scutellum with 5–6 black setulose hairs on apical margin. Hypopygium as in Figure 1, Plate XX. Legs slender, surface hairs long and slender, those on hind tibiæ and tarsi at least four times as long as the joints which bear them; basal joint of hind tarsus as long as the next three combined; fifth nearly one half longer than fourth; claws simple, half as long as fifth joint; empodium small. Wings slender; costa to middle; first vein coalescent with third for a distance equal to twice that from its apex to apex of third, joining costa at nearly a right angle; media forking at cross vein; cubitus forking in vertical line with apex of third vein.

Female.—Similar in color to the male, but the yellow thoracic marks are always more distinct.

The antennæ are short-haired, and their entire length barely exceeds that of head and thorax combined, the last five joints being but slightly elongated and the apical joint swollen. The abdomen is stouter than that of the male, and the surface hairs much shorter. The surface hairs on the legs are less conspicuous than in the male, while the wings are less elongate.

Length, 1–1.5 mm.

Illinois localities: Havana, April 29, 1914; Urbana, July 2, 1914, at light; Grand Tower, April 21, 1914; Ashley, April 25, 1914; Dubois, April 24, 1914; and Algonquin, June 10, 1896.

Originally described from the District of Columbia and Florida.

Nothing is known of the habits of the adult, and the early stages are undescribed.

2. Pseudoculicoides cinctus Coquillett

Ceratopogon cinctus Coquillett, Proc. U. S. Nat. Mus., Vol. 25, 1902, p. 81.

The thorax of this species is entirely covered with dense pruinescence, and is without traces of vittæ. The hypopygium is as shown in Figure 17, Plate XXI.

Length, 1–1.5 mm.

I have seen two males and one female, taken by Mr. Hart at Little Bear Lake, Grand Junction, Mich., July 15, 1914.

Originally described from Lake Worth and Biscayne Bay, Florida, and recorded as biting human beings.

3. Pseudoculicoides major, n. sp.

Male.—Differs from *mutabilis* in being larger, 2 mm., in having the thorax with four brownish vittæ, the center pair posteriorly and the outer pair anteriorly abbreviated; the halteres black or brown with the apices of knob white, and the hypopygium as in Figure 9, Plate XXI.

Female.—Similar to the male in coloration.

Length, 2 mm.

Type locality, Urbana, Ill., July 2, 1914, at light (J. R. Malloch). Allotype from Ithaca, N. Y. (O. A. Johannsen).

The scutellum in both specimens is suffused centrally with brown, and the anterior angles of the thorax are not so distinctly yellow as in the majority of the specimens of *mutabilis* before me, but this character is subject to some variation and can not be depended on.

4. Pseudoculicoides johannseni, n. sp.

Male.—Agrees with *major* in coloration and size, but differs materially in shape of the hypopygium (Pl. XXI, Fig. 10).

Type locality, Palo Alto, California. Submitted by Prof. O. A. Johannsen, after whom the species is named.

Female unknown.

This species and *cinctus* are inserted here to complete the genus, though neither has been found in Illinois.

Forcipomyia Meigen

This genus was erected by Meigen for the reception of two species, the type being designated by Coquillett as *ambiguus* Meigen.*

*The Type-species of North American Diptera, Proc. U. S. Nat. Mus., Vol. 37, 1910, p. 545.

The genus was originally poorly defined, and the type species has been recognized by no one since Zetterstedt's time. It is probably the best course to accept as characters of this genus the very distinctly haired wings and the short basal joint of the hind tarsus, as given in the generic key herewith. In taking this course there is little reason to anticipate objections to it, for previous authors have already adopted it despite the uncertainty that exists regarding the identity of the type of the genus. Kieffer, in "Genera Insectorum",* gives a list of seventeen species belonging to *Forcipomyia,* but strangely leaves out the type species, placing it among the doubtful species in the genus *Ceratopogon* and questioning if it may not be identical with *albipennis* Meigen, which, also, he doubtfully places in *Ceratopogon.* It may be of interest to call attention to Kieffer's inclusion of Coquillett's species *pergandei* and *specularis* in *Ceratopogon* without any question as to the correctness of this course, although both are obviously of the genus *Forcipomyia* according to the original description.

That the species included in the present concept of this genus are entitled to rank generically distinct from those included in *Ceratopogon* in this paper there can not be the slightest doubt, but whether the facts here adduced will hold good for all the species either in North America or any other faunal area remains to be seen.

It has been impossible for me to include all the North American species in my key, not because I am dealing only with those that occur in Illinois, but because many of the species have been so imperfectly described—often without reference to previously described forms, and also, at times, from one sex only—that it is not possible for any one to decide, without reference to the type specimens, how many species are really represented by the forms described. It requires very careful work and examination of slide preparations under a high-power lens, to definitely decide as to the identity of most of the species. Fortunately, realizing this early in the progress of my work, I made an effort to obtain a large supply of fresh material, and, having hundreds of specimens, hope I have succeeded in defining the species before me in such a manner that they will be recognizable by future students.

Key to Illinois Species

1. Females 2
— Males 8
2. Tibiæ, at least mid and hind pairs, with lanceolate scales in addition to the long slender hairs 3
— Tibiæ with only long slender surface hairs 4

*Fasc. 42, p. 52. 1906.

3. Mesonotum shining, with only slight pruinescence; mid and hind tibiæ with lanceolate scales ..... 1. *cilipes.*
— Mesonotum opaque, densely pruinescent; all tibiæ with lanceolate scales ..... 2. *squamipes.*
4. Mesonotum glossy black, without distinct pruinescence; the discal hairs black ..... 3. *specularis.*
— Mesonotum brown or black, shining, and with distinct pruinescence; the discal hairs in large part brassy yellow 5
5. Wings with a distinct patch of pale hairs at apex of third vein ..... 4. *pilosa.*
— Wings without a patch of pale hairs at apex of third vein 6
6. Almost entirely yellow species, only the dorsal surface of abdomen with distinctly black markings ..... 5. *aurea.*
— Black species, pleuræ, abdomen, and legs with yellow markings ... 7
7. Large species, 2.5 mm.; abdomen with distinct yellow postmarginal band to segments ..... 6. *pergandei.*
— Smaller species, 1.75 mm.; abdomen with but slight indications of yellow postmarginal band to segments .. *pergandei*, var. *concolor.*
8. Glossy black species; mesonotum without pruinescence and with black hairs ..... 3. *specularis.*
— Opaque or shining species; mesonotum with distinct pruinescence and a large portion of the discal hairs brassy or golden 9
9. Abdomen with the apex of the segments yellow 10
— Abdomen without yellow apex to segments; basal joint of hind tarsus longer than second (40 : 30); antepenultimate segment of antennæ very slightly more than half as long as preceding segment (16 : 31) ..... 2. *squamipes.*
10. Basal joint of hind tarsus not shorter than second ..... 1. *cilipes.*
— Basal joint of hind tarsus appreciably shorter than second 11
11. Apical segment of antennæ much longer than preapical (20 : 13) .. .. 6. *pergandei.*
— Apical segment of antennæ slightly longer than preapical 12
12. Dorsum of abdomen with narrow yellow hind marginal bands to segments ..... 4. *pilosa.*
— Dorsum of abdomen with broad yellow hind marginal bands to segments ..... 5. *aurea.*

Comparative Lengths of Apical four Antennal Joints and two Basal Joints of Hind Tarsi of Males.*

Species	Antennal joints				Tarsal joints	
	12th	13th	14th	15th	1st	2d
F. cilipes	25	15	11	15	32	31
F. squamipes	31	16	11	13	40	30
F. specularis	21	23	15	22	30	30
F. pilosa	27	18	18	19	28	35
F. aurea	25	21	19	21	35	45
F. pergandei	31	19	13	20	33	38

*See foot-note to table on p. 305.

1. Forcipomyia cilipes Coquillett

Ceratopogon cilipes Coquillett, Proc. Wash. Acad. Sci., Vol. 2, 1900, p. 397.

Larva.—Length, 3–4 mm. White, the apical margins of mandibles brownish. Lateral view as in Figure 3, Plate XVII, dorsal bristles shaped as in Figure 4, Plate XVIII, dorso-lateral bristle fringed (Pl. XVIII, Fig. 5), arrangement of other abdominal bristles as in Figure 3, (Pl. XVII). Claws of pseudopods as in Figures 9 and 10, Plate XVIII.

Pupa.—Length, 2–2.25 mm. Pale yellowish, becoming brown as the enclosed insect matures. Thorax with four long bristles in an anteriorly concave transverse line at center, very similar to those of *Ceratopogon fusculus,* the pair anterior to them long, shaped as in Figure 6, Plate XVIII, posterior portion of thorax without bristles, only slight raised portions indicating where they generally occur in other species; respiratory organ of moderate size (Pl. XVIII, Fig. 2), slightly knobbed at apex. Abdomen with very weak armature, the most distinct being a lateral row of bristles, as shown in Figure 3.

Imago; Male.—Dark brown to black, shining. Antennal plumes dark brown. Tarsi pale yellowish brown. Wings obscured by the dense covering of blackish scalelike hairs; a patch of pale hairs at base and another at apex of third vein; beyond the last-mentioned patch, an elongate patch of black hairs, covering the area between the upper branch of the spurious vein and the margin of wing. Halteres pale lemon-yellow. Thoracic and abdominal hairs varying from blackish brown to pale brown.

Eyes contiguous; antenna with the apical four joints elongated (Pl. XXI, Fig. 6), joints 5–8 of flagellum with the incisions between them poorly defined, the other joints as in Figure 11; antennal length slightly exceeding that of head and thorax combined. Mesonotum glossy black, the marginal hairs long; those on disc much shorter and yellow; scutellar margin with many very long hairs, the disc with short hairs similar to those on mesonotum. Abdomen slender, the segments with numerous long hairs which are noticeably longer than the segments; hypopygium as in Figure 1, Plate XXI. Legs slender, covered with long pale brownish hairs, those on hind tibiæ more than half as long as tibia, basal joint of hind tarsus very slightly shorter than second; fourth and fifth joints of hind tarsus of nearly equal length; claws small, equal; empodium large. Wings narrow, densely hairy; costa to middle; media forking just beyond cross vein.

Female.—Similar to the male in color. Antennæ not longer than head and thorax combined; basal 8 flagellar joints slightly longer than wide, the others slightly elongated, sensory organs as in Figure 5,

Plate XIX, palpi as in Figure 3. Mesonotum with the discal hairs longer than in male. Abdomen broad, slightly longer than head and thorax combined, the surface hairs much shorter than in male; apex as in Figure 4, Plate XIX. Legs stouter than in male, the mid and hind tibiæ with a series of lanceolate scales on dorsal surface in addition to the long slender hairs (Fig. 4, Pl. XXI); tarsi as in male. Wings broader than in male and the surface hairs more numerous; apex of third vein slightly before middle of wing; cubitus forking slightly before apex of third vein.

Length, 1.5–2 mm.

Illinois localities: Havana, reared by C. A. Hart from larvæ and pupæ which were found amongst damp moss on the shore of the Illinois River in June; Urbana, April–July, on windows in the daytime and also at night, both sexes; White Heath, November 22, 1913, in woods; Grand Tower, April, at light, and on shore of Mississippi River; and Dubois, in April.

The original description by Coquillett, was of a female from Alaska. The specimens before me agree with Coquillett's description, and also with a female named by him in the collection of the U. S. Bureau of Biological Survey, from Washington, D. C.

Early stages undescribed.

2. Forcipomyia squamipes Coquillett

Ceratopogon squamipes Coquillett, Proc. U. S. Nat. Mus., 1902, Vol. 25, p. 88.

This species is very similar to *cilipes*. It may be distinguished from it as follows: antennal joints more distinctly nodose, sensory organs more elongated; mesonotum opaque, the disc covered with yellowish gray pruinescence; discal hairs much longer than in *cilipes* and of a brassy color; abdomen more densely haired; all tibiæ with the lanceolate dorsal scales present, those more attenuated at bases; the long slender hairs comparatively longer than in *cilipes;* media with short petiole, the base of the posterior branch indistinct.

Length, 2.5 mm.

Illinois localities: Grand Tower, April 22, 1914, at light; and Urbana, July 23, 1914 (C. A. Hart and J. R. Malloch).

I have before me several males which I believe belong to this species. They agree with the female in coloration except that the tarsi are yellowish and the antennal plumes are blackish. The proportions of the apical four antennal joints are 31, 16, 11, and 13, and the sensory antennal organs are very slender and twice as long as the joints upon which they are situated. Hypopygium as in Figure 3, Plate XXI.

Locality, Grand Tower, April 21, 1914, on bank of the Mississippi River (C. A. Hart and J. R. Malloch).

Originally described from New Mexico by Coquillett. *Ceratopogon brumalis* Long, described from Texas, may be synonymous with this species, though the long, slender tibial hairs are not figured by Long and the larva described by him agrees with that of *ciliPes*. Unless these species are synonymous, nothing is known of the life history of *squamipes*.

This seems an opportune occasion to call attention to the fact that *Ceratopogon ciliatus* Winnertz is very similar to the species here described, though in the absence of European examples it would be rash to suggest that they are synonymous.

3. Forcipomyia specularis Coquillett

Ceratopogon specularis Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 601.

Larva.—Length, 3–3.5 mm. Whitish yellow. Lateral and dorsal views as shown in Figures 1 and 2, Plate XVII. A distinct black eyespot on each side of head; antennæ short, apparently consisting of three joints; dorsal surface of head with a fringed bristle on each side, mandible as in Figure 14, Plate XVIII. Dorsal bristles on the thoracic and abdominal segments shaped as in Figures 17 and 18, Plate XVIII; subdorsal pair on an elevated elongate ridge, their surfaces fringed; lateral bristle fringed; remaining bristles as in Figure 1, Plate XVII; all segments with weak setulæ (Pl. XVIII, Fig. 11).

Pupa.—Length, 2.5–3 mm. A short spine on dorsal surface of head on each side, and a similar one anterior to and slightly dorsad of the respiratory organ, the latter rather knob-shaped; arrangement of dorsal thoracic bristles as shown in Figure 20, Plate XVIII. Abdominal segments, except those enclosed within the larval skin, each with three short bristles on each side, arranged parallel to the anterior margin and slightly posterior to it, and in the intervals between, and slightly posterior to them, are two much longer bristles; all bristles fringed.

Imago; Male.—Black, shining. Antennal plumes black. The membranous area on pleuræ brownish. Tarsi yellowish. Halteres yellow. Wings clear, veins and surface hairs dark brown; a small group of hairs near wing-base and another at apex of third vein white.

Eyes confluent; antenna about equal in length to head and thorax together; basal joint large, globose, flagellum with the basal 9 joints short, as in Figure 12, Plate XXI, their diameter becoming slightly smaller from first to ninth joint, apical four joints as in Figure 8 (denuded); palpi with the third joint less swollen than in the female. Mes-

onotum without traces of pruinescence; discal hairs long and strong, scutellar hairs numerous and long. Hypopygium as in Figure 2, Plate XIX; the long hairs on abdomen located on middle of segment in a transverse row. Legs with long surface hairs, basal joint of hind tarsus subequal to second; fourth slightly longer than fifth. Costa to middle of wing; venation as in Figure 1, Plate XXII.

Female.—Agrees with the male in coloration except that the wings appear darker owing to the more abundant clothing of hairs, and the groups of white hairs are more conspicuous.

Differs from the male in having the antennæ short-haired, the basal nine flagellar joints as in Figure 13, Plate XXI, the sensory organs almost straight, the apical five joints elongated, the last being the longest. In other respects similar to the male except that it is generally much more robust and slightly smaller.

Length: male, 2.5–3 mm.; female, 1.75–2.5 mm.

Illinois localities: Urbana, July and September, and Algonquin, May. Several taken at light in Urbana by Mr. Hart and the writer.

I have before me specimens taken by Mr. Hart at Niles, Mich., July 13, 1914, at light.

Originally described from Pennsylvania, District of Columbia, and Colorado. Subsequently recorded by Howard as having been reared from larvæ found in cow dung in Virginia. All stages have been described by Long* from Texas, the larvæ being recorded as occurring gregariously on the under side of cow dung. In Illinois the larvæ have been found by Mr. Hart, at Urbana, beneath boards lying on the ground.

4. Forcipomyia pilosa Coquillett

Ceratopogon pilosus Coquillett, Proc. U. S. Nat. Mus., Vol. 25, 1902, p. 87.

This species is very similar to *pergandei*, differing principally in color and in the antennal and tarsal proportions of the male. The legs are very bright yellow with a dark suffusion on the hind femora which is sometimes indistinct. The patch of pale hairs at apex of third vein is very distinct in the female.

Illinois localities: Thomasboro, July 20, 1914, both sexes flying about trunk of old apple-tree in the afternoon; St. Joseph, May 3, 1914, and Urbana, May to August, 1914 (C. A. Hart and J. R. Malloch).

I have also seen specimens taken by Mr. Hart at South Haven, Mich., July 15, 1914, at light.

Originally described from the District of Columbia.

Early stages undescribed.

*Biol. Bull., Vol. 3, 1902, p. 7.

5. Forcipomyia aurea, n. sp.

Female.—Yellow, opaque. Head yellow; flagellum of antennæ brownish; proboscis and palpi brown. Mesonotum ochreous yellow on disc, the surface almost entirely opaque and with slight grayish pruinescence; discal hairs golden yellow, with a few long brown setulose hairs on anterior lateral angles and on lateral margins; pleuræ pale yellow, reddish on central portions; scutellum and postnotum brownish yellow, the former with numerous yellow hairs intermixed with longer brown ones. Abdomen pale yellow, each segment from the second to the apex with a large brown spot on each side, leaving only a narrow posterior margin and a fine dorso-central line of the yellow color; ventral surface yellow; dorsal hairs yellowish brown, a patch of short golden yellow hairs on posterior lateral margins of ventral segments. Legs golden yellow, apices of hind femora slightly browned; surface hairs yellow. Wings clear, appearing grayish owing to the dense coating of brown surface hairs, veins brown; no patch of pale hairs at apex of third vein; base of wing yellowish.

Eyes contiguous; antennæ almost the same as in *cilipes*. Basal joint of hind tarsus about a fourth shorter than second; fifth slightly shorter than fourth; surface hairs strong but not very long, the longest not exceeding one and a half times the tibial diameter. Third vein to middle of wing; venation as in *specularis*.

Length, 1.75 mm.

Type locality, Momence, Ill., July 17, 1914, at light (C. A. Hart).

A male taken at the same time and place as the female probably belongs to this species. It differs from the female in being much darker in color, in this resembling very closely the male of *pergandei* next described. The apical four antennal joints are represented in Figure 7, Plate XXI. The basal joint of the hind tarsus is one fifth shorter than the second. The wings are as in the female except that they are comparatively narrower. Hypopygium as in Figure 2, Plate XXI.

Length, 2.5 mm.

A male taken by the writer at Centerville, Ill., August 17, 1914, has the abdomen marked as in the female described above, and the hind tibiæ brown with the exception of the apices. The apices of the hind femora are blackened. In other respects it agrees with the male taken with the type, from which the drawings were made.

Early stages undescribed.

6. Forcipomyia pergandei Coquillett

Ceratopogon pergandei Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 602.

This species differs from *aurea* in being much darker in color, the abdomen having only the apical third of dorsal segments yellow, and in having the legs considerably blackened. The male is very similar to that here described as *aurea,* but the antennal and hind tarsal proportions are quite dissimilar (Pl. XXI, Fig. 5). The hypopygium is similar to that figured for *aurea.*

Length, 2.5–2.75 mm.

Illinois localities, Grand Tower, April 22, 1914, and Urbana, July 7, 1914, both at light (C. A. Hart and J. R. Malloch).

Originally described from the District of Columbia.

The larva of what I consider as the typical form of this species was taken by Prof. A. D. MacGillivray under bark of a fallen tree. Larval and pupal details are given in Figures 15, 8, and 21 of Plate XVIII.

Var. *concolor,* n. var.

Similar to the foregoing except that it is noticeably smaller, 1.75 mm., and has the dorsum of the abdomen without distinct pale postmarginal band to the segments.

Localities, Grand Tower, along with the type form, and Urbana July 4–7, on windows (C. A. Hart and J. R. Malloch).

Palpomyia Meigen

I have recently revised this genus in the Bulletin of this Laboratory,* and herewith present a synopsis of the species with such alterations and notes as are required to bring our information up to date.

Since the publication of the paper referred to I have succeeded in obtaining several additional species which have caused me to change the generic location of some of those I had placed in *Palpomyia.* I suggested in the previous paper that *rufa* Loew might belong to the genus *Heteromyia,* and I find this to be the case on examination of a specimen from Ithaca, N. Y. I have also removed *trivialis* Loew to *Heteromyia.*

My knowledge of the early stages of the species of this genus is not sufficient to warrant even an opinion as to whether the larvæ or the pupæ may be separated from those of allied genera by any characters which the species possess in common.

*Vol. X, Art. 4 (1914), p. 216.

KEY TO SPECIES

1. Halteres with black knob....2
— Halteres with yellow knob....5
2. Mesonotum opaque gray, with central brown vitta; fore femora with 10–12 spines on apical half; mid and hind femora with but 1 distinct spine; claws large, subequal, toothed near base; last tarsal joint unarmed....1. *illinoensis.*
— Mesonotum black, without central vitta....3
3. Fore femora with one spine at middle, the other femora bare....2. *scabra.*
— All femora with spines....4
4. Hind tibiæ entirely black; third vein to about five sixths the wing-length....3. *tibialis.*
— Hind tibiæ yellow, their apices blackened; third vein to nine tenths the wing-length....4. *subaspcr.*
5. Only one pair of femora, fore or hind, with spines....6
— All femora spinose or only fore femora bare....7
6. Fore femora with 1 spine at middle, the other femora bare....2. *scabra.*
— Hind femora spinose, the other femora bare; legs yellow, apices of femora, of tibiæ, of first 3 tarsal joints and whole of last 2 tarsal joints blackish brown; claws of fore and mid tarsi subequal, those of hind pair very unequal in length; hind femora with 2 spines....5. *curriei.*
7. Legs yellow, middle and extreme apices of hind femora, the hind tibiæ except a small portion beyond middle, the apices of fore and mid tibiæ and bases of latter, and last 3 tarsal joints blackened; middle portion of the thickened last tarsal joint of fore legs white; claws of fore tarsi equal, those of mid and hind pairs very unequal in length; all femora with 1 spine....6. *nebulosa.*
— Mid and hind femora with at least 2–3 ventral spines....8
8. Mesonotum densely gray pollinose, without distinct brown spots or vittæ; legs almost entirely blackish brown....7. *schwarzi.*
— Mesonotum either glossy black, or opaque gray with distinct brown spots on disc....9
9. Mesonotum glossy black; wings with a large black spot..8. *nubifera.*
— Mesonotum opaque gray; wings clear....10
10. Apices of fore femora yellow....9. *longipennis.*
— Apices of fore femora blackened....10. *slossonæ.*

1. PALPOMYIA ILLINOENSIS Malloch

Palpomyia illinoisensis Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, Art. 4 (1914), p. 219.

The type specimen is from Algonquin, Ill.

I have seen a single specimen from Ithaca, N. Y., which does not differ from the type except in having the spines on fore femora in a

rather distinct group which does not extend as far towards middle of femora, and 4 spines in place of one spine on hind femora. The pupa from which this specimen was reared has the thoracic respiratory organ as in Figure 16, Plate XXI. A specimen in the collection of the U. S. Bureau of Biological Survey collected at Four Mile Run, Va., has the legs considerably darker in color and the spines on the femora as in the New York specimen. These may represent distinct species, but a series of specimens is necessary to enable one to give a definite opinion. In all probability it is this last form which appears as *Palpomyia lineatus* Meigen in the New Jersey list, but that species has the cubitus forking before the cross vein, which is not the case in the specimens before me.

2. Palpomyia scabra Coquillett

Ceratopogon scaber Coquillett, Jour. N. Y. Ent. Soc., Vol. 13, 1905, p. 62.
Palpomyia scabra (Coquillett) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, Art. 4 (1914) p. 221.

Described from Frontera, Tabasco, Mexico, and, as far as I am aware, not since recognized. Date of occurrence, February 22 (C. H. T. Townsend).

3. Palpomyia tibialis Meigen

Ceratopogon tibialis Meigen, Syst. Beschr. Eur. Zweifl. Ins., Vol. 1, 1818, p. 82, sp. 36.
Palpomyia tibialis (Meigen) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, Art. 4 (1900), p. 222.

In addition to the two localities already recorded for this species in Illinois,* Algonquin and Anna, I have seen an example taken at Momence, July 17, 1914, by C. A. Hart.

I have seen females of this species, submitted by Prof. O. A. Johannsen, from the following localities in New York State: Ithaca, McLean, 2–3 July, 1904; Mud Creek, Tompkins Co., 17–20 June, 1904; Freeville, July 4, 1904; Ellis, June 13, 1904.

4. Palpomyia subasper Coquillett

Ceratopogon subasper Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 606.
Palpomyia subasper (Coquillett) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, p. 222.

In addition to the following Illinois localities already recorded in previously cited paper—Algonquin, Urbana, White Heath, Savanna,

*Bull. Ill. State Lab. Nat. Hist., Vol. 10, Art. 4 (1914), p. 222.

St. Joseph, and Havana—I took a series of specimens of both sexes while collecting at Monticello, June 21–28, 1914, in company with C. A. Hart. The specimens were obtained by sweeping vegetation, and nothing was discovered as to their habits. I have seen this species also from Ithaca, N. Y.

Originally described from Mexico.

5. Palpomyia curriei Coquillett

Ceratopogon curriei Coquillett, Jour. N. Y. Ent. Soc., Vol. 13, 1905, p. 62.
Palpomyia curriei (Coquillett) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, p. 219.

Originally described from British Columbia and not subsequently recorded.

I have a male specimen of a species obtained at Mahomet, Ill., August 6, 1914, which agrees fairly well with Coquillett's description, but am averse to expressing an opinion as to its identity without seeing the female.

6. Palpomyia nebulosa, n. sp.

Female.—Black, shining. Head brownish black; antennæ brown, scape, first joint of flagellum and bases of the next 5–6 joints yellow; proboscis, palpi, and hairs on antennæ brown. Mesonotum without traces of pruinescence; pleuræ less distinctly shining on upper half than disc of mesonotum, the lower half brownish and highly polished except above, where there is a broad longitudinal band of silvery pruinescence which is most distinct when viewed from above. Abdomen glossy black. Legs, including the coxæ, yellow, blackened on middle and apices of posterior femora, on apices of fore tibiæ, broadly on bases of middle tibiæ and on bases and apices of hind tibiæ, the apical three joints of all tarsi black except the middle of apical joint of fore pair, which is broadly white. Wings with a broad nebulous infuscation at middle; veins thick, deep brown. Halteres yellow, knob white.

Eyes separated by about one sixth the head-width; antennæ with second joint globose, the flagellum very slender, the entire length almost equal to that of the insect. Mesonotum with the setulose hairs much below normal size and very sparse, the disc bare except for the usual 3 longitudinal lines; lateral and anterior setulæ weak and sparse. Abdomen club-shaped, without distinct hairs. Legs elongate; femora not swollen, each with a single weak thorn near the apex of ventral surface; fourth tarsal joint on all legs obcordate, the apices of each drawn out laterally and armed with two bristles; fifth tarsal joint of fore legs much thickened, that of the other legs elongated and not so distinctly thickened, none of them with ventral bristles; entire length

of hind tarsus distinctly exceeding that of hind tibiæ, the basal joint longer than the remaining joints combined; claws of fore tarsi equal in length, those of the mid and hind pairs very unequal. Apex of third vein extending to four fifths of the wing-length; first vein not reaching to middle of last section of third, that portion of first beyond the cross vein less than half as long as section preceding it; media forking distinctly in front of cross vein; cubitus forking in line with base of posterior branch of media.

Length, 3.5 mm.

Type locality, Little Bear Lake, Columbia, Mich., July 15, 1914 (C. A. Hart). Paratype from Polk Co., Wis., July (Baker).

This species is distinguished from any previously described from North America by the single bristle on each femur, by the infuscated wings, and by the peculiar color of the fifth tarsal joint of the fore legs.

7. Palpomyia schwarzi Coquillett

(Pl. XXII, Fig. 10)

Ceratopogon schwarzi Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 605.
Palpomyia schwarzi (Coquillett) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, p. 224.

No additional records of this species are available. The Illinois localities are Algonquin, Urbana, and Champaign.

Originally described from Texas.

8. Palpomyia nubifera Coquillett

Ceratopogon nubifer Coquillett, Jour. N. Y. Ent. Soc., Vol. 13, 1905, p. 61.
Palpomyia nubifera (Coquillett) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, p. 217.

Described from a single female specimen obtained by Mrs. A. T. Slosson at Jacksonville, Florida. Not subsequently recorded.

9. Palpomyia longipennis Loew

Ceratopogon longipennis Loew, Berl. Ent. Zeitschr., 1861, p. 313, sp. 10.
Palpomyia longipennis (Loew) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, p. 221.

Larva.—Length, 15 mm. White. Head twice as long as broad; antenna remarkably small, consisting apparently of three segments, the basal one about 1.5 times longer than either of the other two and much thicker; mandibles (Pl. XVIII, Fig. 12) brown on apical half; labial

plate simple in form (Fig. 13); hypopharynx as in Figure 16. Abdomen without surface hairs; two leglike organs with warty processes near the posterior margin* of each segment on the ventral side; apical segment with eight hairs, four on each side, the anterior two widely separated, the apical two close together; within the apical third of the last segment are two retractile organs (their apices unarmed with claws) which greatly resemble the posterior pseudopods of other chironomid larvæ.

The pupal and adult stages are described on pages 219–221 of this volume of this Bulletin (Article IV).

Illinois localities: Algonquin and Havana. Larvæ were obtained in considerable numbers from Thompson's Lake, near Havana, at a depth of eight and a half feet. These were successfully reared to the adult stage, by the writer, in 2-dram vials, in a room of the State Laboratory. The pupæ were found floating in the Illinois River near Havana. It was observed that pupæ kept in vials in which there still remained a little water did not entirely leave the water before emergence of the adult, as do certain other species of this genus, but remained with the apical half of the abdomen submerged.

Originally described from Pennsylvania, and subsequently recorded from New Jersey by Smith.

10. Palpomyia slossonæ Coquillett

Ceratopogon slossonæ Coquillett, Jour. N. Y. Ent. Soc., Vol. 13, 1905, p. 61.
Palpomyia slossonæ (Coquillett) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, p. 224.

Originally described from a female specimen obtained on Mt. Washington, N. H., by Mrs. A. T. Slosson. Not subsequently recorded.

Heteromyia Say

Differs from *Palpomyia* in having the fore femora thickened and spinose ventrally, and the other femora without spines. From *Bezzia* and *Probezzia* the genus is distinguished by having the second vein present, and from *Johannsenomyia* by the presence of femoral thorns. *Serromyia* is distinguished from *Heteromyia* by the much thickened and spinose hind femora.

I give herewith a key to those species which have the wings unmarked.

*As these organs are also present on the last thoracic segment and absent from the penultimate abdominal one, I may be mistaken in considering them as situated on the posterior margin, though they so appear in the mounted specimens before me.

The species of this genus which have spots or bands upon the wings are *fasciata* Say, *clavata* Williston, *festiva* Loew, and *pratti* Coquillett.* I have taken none of these species in Illinois.

Key to Species

1. Halteres pale yellow 2
— Halteres black or brown 4
2. Yellow species ..... 1. *rufa.*
— Black species 3
3. Apices of mid and hind femora, bases of mid tibiæ, and whole of hind pair blackened; fore femora slightly thickened and with 3—4 spines ..... 2. *aldrichi.*
— Legs entirely yellow; fore femora much thickened and with 16 or more spines ..... 3. *plebeia.*
4. Legs almost entirely yellow 5
— Mid and hind legs conspicuously blackened 6
5. Fifth tarsal joint with ventral spines; scape of antennæ yellow ..... 4. *cressoni.*
— Fifth tarsal joint without ventral spines; scape of antennæ black ..... 5. *tenuicornis.*
6. Scape of antennæ yellow; claws of hind tarsi very distinctly longer than those of fore and mid pairs ..... 6. *trivialis.*
— Scape of antennæ black; claws of hind tarsi not longer than those of fore and mid pairs 7
7. Mesonotum subopaque black ..... 7. *opacithorax.*
— Mesonotum glossy black 8
8. Disc of mesonotum with very distinct pale hairs ..... 8. *hirta.*
— Disc of mesonotum with at most very short hairs, generally bare ..... 9. *flavipes.*

1. Heteromyia rufa Loew

Ceratopogon rufus Loew, Berl. Ent. Zeitschr., 1861, p. 314, sp. 12.
Palpomyia rufa (Loew) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, p. 217.

In my recent revision of the genus *Palpomyia*† I suggested the possibility of this species belonging to *Heteromyia*. At that time I had not seen the species, but subsequently Professor Johannsen sent me an example, with a number of other species, from Ithaca, N. York, and Mr. Cresson sent me another from his collection, taken at Swarthmore, Pa. It may be well to indicate its specific characters here.

Female.—Reddish yellow, shining. Flagellum of antennæ, extreme apices of mid femora, apical third of hind femora, apices of hind tibiæ, and last three tarsal joints brownish.

*For key to these species see "Addendum to *Ceratopogonina*," page 360.
†Bull. Ill. State Lab. Nat. Hist., Vol. 10, Art. 4 (1914), p. 217.

Eyes distinctly separated; antenna more than one and a half times as long as head and thorax together. Disc of mesonotum with very short pale hairs closely placed; 3–4 black setulæ in front of wing-base. Fore femora much thickened, the anterior surface with 2–3 irregular rows of short black thorns on almost their entire length; fifth tarsal joint unspined; tarsal claws equal, of moderate size, with a median tooth on the inner side. Third vein to five sixths the wing-length; first, to less than two fifths the length of third; last section of first slightly shorter than penultimate section of third; media forking before cross vein, base of its posterior branch indistinct; cubitus forking proximad of cross vein.

Length, 3.75 mm.

Originally described from Pennsylvania. Early stages unknown.

2. Heteromyia aldrichi, n. sp.

Female.—Black, shining. Head black, antennæ, face, and palpi blackish brown. Thorax black, shining. Abdomen brownish black on dorsum, ventrally yellowish, the segments of the apical half with a brown spot on each side. Legs yellow, mid and hind coxæ, apices of middle femora and bases of their tibiæ, apical third of hind femora and the whole of their tibiæ, and apical two joints of all tarsi blackened. Wings clear, veins yellowish. Halteres whitish.

Eyes separated by about a fifth the width of head; joints of basal half of flagellum slightly longer than wide. Disc of mesonotum with numerous rather weak hairs. Fore femora slightly thicker than hind pair and with three spines on apical half of ventral surface; fifth tarsal joint without ventral spines; claws small, equal. Third vein ending at about three fourths the wing-length; first ending at two fifths the length from base of third; media forking before cross vein, base of posterior branch indistinct; cubitus forking very slightly beyond cross vein.

Length, 2.75 mm.

Type locality, Moscow, Idaho (J. M. Aldrich).

I have no hesitation in locating this species in *Heteromyia* because of the presence of spines on the fore femora only, and because of the small tarsal claws, which are similar throughout this group of the genus.

The species is named in honor of Professor J. M. Aldrich, who kindly donated the specimen.

A paratype from Berkley Hills, Alameda county, Cal., April 11, 1908, submitted by Mr. Cresson, has the abdomen paler than the type, but in other respects agrees with the above description. This speci-

men is in the collection of the Philadelphia Academy of Natural Sciences.

3. Heteromyia plebeia Loew

Ceratopogon plebius Loew, Berl. Ent. Zeitschr., 1861, p. 313, sp. 11.

Male.—Black, shining. Face and antennæ brown, palpi yellow. Abdomen yellow at base. Legs yellow, apices of fore and mid femora narrowly, of hind femora broadly, blackened; apical 2–3 joints of tarsi brown. Wings clear, veins pale brown. Halteres pale yellow.

Eyes narrowly separated; antenna more than one and a half times as long as head and thorax combined. Disc of mesonotum with numerous short blackish hairs; a few setulæ on margins in front of wing-base, and on margin of scutellum. Hypopygium smaller than usual in this family. Fore femora much swollen, the thorns beginning just before middle and reaching to apex; fifth tarsal joint unspined; tarsal claws small, equal, without distinguishable middle tooth. Third vein to slightly less than three fourths the wing-length; first ends at middle of third, its last section distinctly shorter than penultimate section of third; media forking before cross vein, its posterior branch with base indistinct; cubitus forking slightly beyond cross vein.

Female.—Differs from the male in having the head yellow, the antennæ with only the flagellum brown; the abdomen more broadly yellow at base, and the legs with the dark marks less distinct.

The antennal flagellum is very slender, and the entire antennal length is about three fourths that of the insect itself. The tarsal claws are longer than in the male, and have the central tooth distinct. The third vein extends to four fifths of the wing-length. In other respects as the male.

Length: male, 1.75–2.5 mm.; female, 2.5–3 mm.

Localities: Monticello, Ill., June 28, 1914, swept from vegetation on bank of Sangamon River; Little Bear Lake, Columbia, Mich., July 15, 1914, swept from vegetation; Ithaca, N. Y. (O. A. Johannsen).

Originally described from Pennsylvania.

Early stages unknown.

4. Heteromyia cressoni, n. sp.

Female.—Head yellow, vertex and flagellum of antennæ fuscous. Thorax brownish black, shining, anterior lateral angles yellowish; pleuræ highly polished. Abdomen yellow. Legs yellow, coxæ brownish; tarsal claws black. Wings clear, veins yellowish. Halteres yellow. Knob pale brown.

Frons narrow anteriorly, the sides diverging posteriorly; antennæ with the basal nine joints of flagellum distinctly longer than their

diameter; apical joint of palpi barely longer than preceding joint. Disc of mesonotum microscopically reticulated and with rather closely placed short hairs. Legs slightly elongated, fore femora distinctly but not greatly thicker than hind pair, their ventral surfaces with about eight black spines extending from before middle to apex; fifth tarsal joint with ventral spines; tarsal claws of moderate length, those on the hind legs distinctly longer than the others, each pair subequal in length and with inner tooth. Third vein ending at about four fifths the wing-length; first ending slightly before middle of third; media forking close in front of cross vein; cubitus forking below cross vein.

Length, 3.5 mm.

Type locality, Swarthmore, Pa., June 8, 1905 (E. T. Cresson, Jr.).

This species resembles some of those in *Palpomyia* in having ventral bristles on the fifth tarsal joint, but there are no spines on the mid and hind femora, which points to its closer association with *Heteromyia*, though the line of demarcation between these genera is rather an arbitrary one as at present defined.

The species is named in honor of the collector.

5. Heteromyia tenuicornis, n. sp.

Female.—Black, glossy. Head black; flagellum of antennæ yellowish on basal half, the apices of joints and the apical half fuscous, scape black; palpi reddish. Mesonotum without trace of pruinescence; pronotum brownish. Abdomen brown, yellowish at base and ventrally. Legs reddish yellow, mid and hind coxæ, knee joints, extreme apices of hind tibiæ, and apical two tarsal joints blackened. Wings clear, veins yellow. Halteres yellow, apically brownish.

Eyes separated by less than one eighth the width of head; antennæ slender, extending to about middle of abdomen, the basal eight flagellar joints each about four times as long as their diameter; apical joint of palpi much longer than preceding joint. Disc of mesonotum with very inconspicuous hairs. Abdomen much longer than head and thorax together. Legs slender, fore femora distinctly but not greatly thicker than hind pair, their ventral surfaces with 6–7 black spines on apical half; hind tibiæ with only weak decumbent hairs; basal joint of hind tarsi about half as long as hind tibiæ; fifth tarsal joint unspined; claws short, subequal. Third vein ending at about five sixths the wing-length; first ending at about two fifths the length from base of third; cross vein at wing-middle; media forking distinctly proximad of cross vein; cubitus forking below base of posterior branch of media.

Length, 3.5–4 mm.

Type locality, Polk Co., Wis., July (Baker).

6. Heteromyia trivialis Loew

Ceratopogon trivialis Loew, Berl. Ent. Zeitschr., 1861, p. 309, sp. 4.
Palpomyia trivialis (Loew) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, p. 217.

Female.—Black, shining. Scape of antennæ, fore femora, bases of mid and hind femora, apices of fore tibiæ, and bases of all the tarsi yellow. Wings slightly grayish, veins brown, the thick veins very distinct. Halteres black.

Eyes distinctly separated; antennæ about one and a half times as long as head and thorax together. Disc of mesonotum without distinct hairs. Fore femora distinctly thicker than mid pair but not thicker than hind pair, the thorns (3–4) confined to apical half; claws of fore and mid tarsi simple, equal, rather small, those of hind tarsi distinctly longer but of similar structure. Third vein extending to four fifths of the wing-length, slightly thickened; first, to one third the length of third, its last section equal to penultimate section of third; media forking distinctly before cross vein, the base of posterior branch obsolete, cubitus forking distinctly before cross vein.

Length, 2–2.5 mm.

Localities: Muncie, Ill., May 24, 1914; and Monticello, Ill., June 21, 1914. Swept from vegetation along the banks of streams by C. A. Hart and the writer.

Originally described from the District of Columbia, and subsequently recorded by Smith from New Jersey.

I have decided that this species belongs more properly to *Heteromyia* than to *Palpomyia* because of the thickening of the fore femora and the absence of spines from the other pairs. I had not seen the species when I wrote my recent revision of the genus *Palpomyia*.

7. Heteromyia opacithorax, n. sp.

Female.—Differs from *hirta* and *flavipes* in being much more robust, in having the thorax subopaque, the surface with slight pruinescence and slightly granulose, the scutellum much broader, and the legs more obscured by black. The antenna is barely longer than head and thorax together, and the third vein reaches to more than three fourths of the wing-length. Tarsal characters as in *flavipes*.

Length, 2 mm.

Type locality, St. Joseph, Ill., May 17, 1914. Paratype from Dubois, Ill., April 24, 1914. Swept from vegetation along banks of streams.

Nothing is known of the early stages.

8. Heteromyia hirta, n. sp.

Female.—Similar in coloration to *flavipes*. Structurally separable by the following characters: antennæ not more than one and a fourth times as long as head and thorax together; mesonotum with closely placed, very distinct hairs; third vein to less than three fourths the wing-length.

Male.—Differs from the male of *flavipes* in having the mesonotum with distinct hairs and the hypopygium much smaller.

Length: male, 1.5 mm.; female, 2–2.5 mm.

Type locality, Muncie, Ill., May 24, and July 5, 1914. Taken by the writer under the same conditions as *flavipes*.

9. Heteromyia flavipes Meigen

Ceratopogon flavipes Meigen, Syst. Beschr. Eur. Zweifl. Ins., Vol. 1, 1818, p. 82, sp. 35.

Female.—Glossy black. Base of abdomen sometimes yellowish. Legs yellow, coxæ, apices of femora, apices of fore and mid tibiæ (narrowly) and of posterior pair (broadly), apical three joints of fore and mid tarsi and whole of posterior pair, blackened. Wings slightly grayish, veins brown. Halteres black, stems yellowish.

Frons narrow, the sides converging anteriorly; antennæ with the second joint of moderate size, flagellum slender, entire length of antenna equal to one and a half times the combined length of head and thorax. Mesonotum without distinct discal setulæ. Abdomen elongate, slightly flattened. Legs strong, fore femora distinctly thicker than the mid and hind pairs, their apical half with about twelve short stout thorns on antero-ventral surface; mid and hind femora unarmed; hind tibiæ with the hairs on dorsal surface rather setulose; basal joint of hind tarsus slightly thickened, tapering to apex, as long as next three joints combined; fourth joint of all tarsi short, obcordate; fifth joint more than twice as long as fourth, without ventral spines; claws on all legs subequal, those on hind tarsi not longer than on the other pairs. Third vein to four fifths the wing-length; first not reaching to middle of last section of third, the section beyond the cross vein about one third as long as preceding section; media forking distinctly in front of cross vein; cubitus forking in line with base of posterior branch of media.

Male.—Much darker than the female; legs black, the fore pair except apices of tarsi, the bases of mid and hind femora, and bases of tarsi yellow; mid and hind tibiæ generally much obscured by black.

Antenna about one and a half times as long as head and thorax combined. Hypopygium large, protruding, apical portion of lateral arm about two thirds as long as basal portion, tapering to a fine point, at apex distinctly incurved. Legs as in female, though the fore femora have fewer thorns. Third vein extending slightly less than to three fourths the wing-length; first vein slightly less than half the length of third; cubitus forking very slightly beyond the cross vein.

Length: male, 2–2.5 mm.; female, 2.5–3 mm.

Illinois locality, Muncie, July 5, 1914. A very large series of both sexes was taken May 24, 1914, at the same place. All the specimens were taken, by Mr. Hart and the writer, in sweeping vegetation on the banks of Stony Creek.

The only previous record of this species from this country is that contained in the New Jersey list of insects. Originally described from Europe.

Serromyia Meigen

This genus is, as far as is known, represented in Illinois by a single species, though it is possible that *femorata* Meigen may also occur.

1. Serromyia femorata Meigen

Ceratopogon femoratus Meigen, Klass. u. Beschr. Eur. Zweifl. Ins., Vol. 1, 1804, p. 24.

Serromyia femorata Meigen; Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, p. 217.

This species was originally described from Europe, where it is one of the commonest species belonging to the group with spinose femora. It has been recorded from Alaska, by Coquillett, and I have seen a female specimen, submitted by Professor Johannsen, from Ellis, N. Y., June 13, 1904.

2. Serromyia crassifemorata Malloch

Serromyia crassifemorata Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, Art. 4 (1914), p. 218.

This species is separable from *femorata* by the structure of the hind tarsal claws, which are equal in length, whereas in *femorata* they are very unequal, the inner being four times as long as the outer.

Type locality, Mt. Carmel, Ill., May 28, 1884 (H. Garman). Two females. I have seen no other specimen.

Johannsenomyia, nov. nom.

In my previous paper in this Bulletin, Article IV of this volume, I included all the species previously placed in *Johannseniella* by various authors, but have now erected another genus, *Hartomyia,* for the reception of species having the media petiolate. In the present paper I have, therefore, restricted the scope of *Johannsenomyia,* including in it only those species which have the media furcate proximad of the cross vein. The change of name from *Johannseniella* to *Johannsenomyia* becomes necessary because of the following facts: *Ceratolophus* was erected by Kieffer* with one species included, *femoratus* Meigen; but as the type species is also the type of *Serromyia*†, *Ceratolophus* is a synonym of *Serromyia.* Failing to recognize this fact, Kieffer proposed to replace the name *Ceratolophus* Kieffer, not Boucort (1873), with the name *Johannseniella,* thereby inadvertently adding another synonym to *Serromyia.* As the name he proposed was intended as a compliment to a worker who is a distinguished authority on the group, I consider it advisable to retain the generic name in a form as near to the original as possible.

Kieffer in a paper in the Memoirs of the Indian Museum‡ dealing with Indian *Chironomidæ* makes *Johannseniella* a synonym of *Sphæromyas,* ignoring the fact that the type of the latter, *fasciatus* Meigen, does not possess the characters indicated in his description of that genus.

Key to Species

1. Wings with distinct black marks other than the infuscation on the cross vein 2
— Wings without any black marks, only the cross vein in some species infuscated 3
2. Wings with 2 black spots; tibiæ entirely black ..... 1. *dimidiata.*
— Wings (Pl. XXII, Fig. 12) with 2 black spots; tibiæ black at apices only ..... 2. *bimaculata.*
3. Abdomen covered with silvery pruinescence ..... 3. *argentata.*
— Abdomen without silvery pruinescence 4
4. Cross vein of wing very conspicuously darker than other veins, which with the field of the wing are whitish ..... 4. *albaria.*
— Cross vein of wing not darker than other veins, wings either grayish or hyaline, veins brownish 5
5. Yellow species ..... 5. *flavidula.*
— Black or blackish brown species 6
6. Last tarsal joint without spines on the ventral surface 7
— Last tarsal joint with distinct spines on the ventral surface 12

*Bull. Soc. Ent. France, 1899, p. 69.

†See Meigen's Syst. Beschr. Eur. Zweifl. Ins., Vol. 1, 1818, p. 83.

‡Vol. 2, 1910, p. 194.

7. Halteres pale; fore and mid tarsal claws short, subequal, hind pair very unequal, the inner about 4 times as long as the outer..... ..... 6. *polita.*
— Claws on all tarsi subequal 8
8. Halteres brown, tarsal claws small.....9
— Halteres pale, yellow or white.....10
9. Distance from cross vein to apex of third much greater than that from apex of third to apex of wing; hypopygium very large..... ..... 7. *æqualis.*
— Distance from cross vein to apex of third subequal to that from apex of third to apex of wing; hypopygium small.....8. *caudelli,* ♂.
10. Small species, 1 mm.; claws minute, third vein united to first on its basal fourth .....*Hartomyia arctica** (p. 343).
— Larger species, at least 1.75 mm.; claws rather large, third vein united to first by the normal cross vein.....11
11. Small species, 1.75 mm., third vein extending almost to apex of wing ..... 9. *macroneura.*
— Larger species, 4 mm.; third vein extending to five sixths the wing-length ..... 10. *magna.*
12. Tarsal claws on all legs unequal; posterior branch of media obliterated except near apex..... 11. *stigmalis.*
— Tarsal claws on all legs subequal; posterior branch of media distinct except at its base 13
13. Antenna not as long as head and thorax together; halteres yellow, sometimes brownish; hind tarsus with basal joint as long as next 3 joints combined.....8. *caudelli,* ♀.
— Antenna slightly longer than head and thorax combined; knob of halteres black; hind tarsus with basal joint as long as remaining joints combined .....12. *halteralis.*

1. Johannsenomyia dimidiata Adams

Ceratopogon dimidiatus Adams, Bull. Kans. Univ., Vol. 2, 1903, p. 27.
Johannseniella dimidiata (Adams) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, p. 226.

I have not seen this species, which was originally described by Adams from Arizona. It is very closely related to *bimaculata* Loew.

2. Johannsenomyia bimaculata Loew

Ceratopogon bimaculatus Loew, Berl. Ent. Zeitschr., 1861, p. 311, sp. 6.
Johannseniella bimaculata (Loew) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, p. 227.

I redescribed this species in Article IV of Volume X of this Bulletin (p. 227).

*This species is inserted here as well as in *Hartomyia* because of a slight doubt as to its generic position.

Illinois localities: Pulaski, Algonquin, Monticello, and Urbana. Taken on dates ranging from the end of June to the end of August.

Early stages and habits unknown.

3. Johannsenomyia argentata Loew

Ceratopogon argentatus Loew, Berl. Ent. Zeitschr., 1861, p. 310, sp. 5.
Johannseniella argentata (Loew) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, p. 226.

Female.—Black, shining. Head yellow, apices of the short joints of flagellum of antennæ and the whole of the apical five joints brown. Abdomen black, the surface obscured by dense silvery pruinescence. Legs yellow, blackened on mid and hind coxæ, on middle of hind femora and their extreme apices, on basal half of hind tibiæ, also apical three joints of all tarsi. Wings with a slight infuscation on cross vein, along anterior branch of media, and on the cells between radius and costa. Halteres black.

Eyes separated by a narrow line; antenna reaching to about middle of abdomen. Mesonotum with the disc covered with short closely placed pale hairs, lateral view of anterior half as in Figure 5, Plate XXIII. Abdomen slightly spatulate. Legs slender, noticeably elongated; basal joint of hind tarsus longer than the remaining joints together; fifth tarsal joint on all legs with a row of 6–7 long bristles on each side of ventral surface extending from base somewhat beyond the middle; inner claw of each tarsus about a fourth as long as the outer. Third vein to about seven eighths of the wing-length; first vein about a third the length of third; media forking distinctly in front of cross vein; cubitus forking below the base of posterior fork of media.

Length, 3.5–4.5 mm.

Illinois localities: Pike, May 26, 1906; Monticello, June; Lilly, June 11; Mt. Carmel, June 30; Algonquin, June and July; Urbana and Havana, July; and Centerville, August 16.

It is strange that out of thirty-eight specimens in the collection here there should be no males. The females undoubtedly do predominate in *Ceratogoponinæ*, but this is an exceptional instance. Prof. J. M. Aldrich has taken numerous females of this species at Lafayette, Ind., but no males. By an unfortunate slip this species was not described in my revision of the genus published in Article IV of this volume.

Originally described from Washington, D. C.

Early stages and habits of adults unknown. The male is undescribed.

4. Johannsenomyia albaria Coquillett

Ceratopogon albarius Coquillett, Proc. Acad. Nat. Sci. Phil., 1895, p. 308.
Johannseniella magnipennis Johannsen, Bull. 124, N. Y. State Mus., 1908, p. 268.
Johannseniella albaria (Coquillett) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, p. 228.

In addition to Algonquin, Urbana, and Havana, Illinois localities already recorded, specimens of this species have been added to the Laboratory collection this year (1914) from the following localities, also in Illinois: Muncie, May and July, Monticello, June, and Sumner, August 2.

Females only have been taken, and no information as to the habits of the adult has been obtained.

5. Johannsenomyia flavidula Malloch

Johannseniella flavidula Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, Art. IV. (1914), p. 230.

Havana and Algonquin are the localities already recorded for this species, and Mr. Hart and the writer took large numbers of the pupæ from the Big Muddy River near Grand Tower, Ill., in April 1914, from which both sexes were reared.

6. Johannsenomyia polita Coquillett

Ceratopogon politus Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 606.
Johannseniella polita (Coquillett) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, p. 227.

Female.—Glossy black. Legs brownish black, apices of tibiæ paler, tarsi whitish yellow. Knobs of halteres whitish yellow.

Eyes narrowly separated; antenna short, barely as long as head and thorax together. Mesonotum with the discal hairs rather long, those on center confined to the normal three lines; the setulose hairs in front of wing-base and on margin of scutellum very long. Legs not noticeably thickened nor elongated; basal joint of hind tarsus not half as long as hind tibia and equal in length to the next three joints combined; fifth tarsal joint unspined; fore and mid tarsi with the claws subequal, hind pair with the inner four times as long as the outer. Third vein to two thirds the wing-length; first vein to middle of third; media forking at cross vein, the base of the posterior branch indistinct; cubitus forking below cross vein.

Length, 1.5 mm.

I have not seen this species from Illinois, the only example I have being a female submitted by Prof. O. A. Johannsen, taken at Ithaca, N. Y.

Originally described from Massachusetts. The male is undescribed.

Early stages and habits of adult unknown.

Coquillett states that the eyes are very widely separated, but in the specimen before me they are only narrowly so, though the vertex has the eyes widely diverging posteriorly, which may be what Coquillett saw instead of the frons.

7. Johannsenomyia æqualis, n. sp.

Male.—This species agrees in coloration and size with *polita,* except that the halteres are brown and the antennal flagellum on basal half and its plumes are yellow.

The eyes are widely separated; antenna slightly longer than head and thorax combined, basal joint of flagellum one and a half times as long as second; apical five joints elongated. Mesonotum not so highly polished as in *polita,* the hairs and their disposition similar to those of that species. Abdomen short; the hypopygium exceptionally large, about equal in length to remainder of abdomen, basal portion of lateral arm about four times as long as its diameter, apical portion about two thirds as long as basal, its apex in the form of a long slender hook. Legs slender; basal joint of hind tarsi slightly longer than remaining joints together; fifth tarsal joint unspined; tarsal claws rather small, equal on all legs. Third vein to four fifths the wing-length; first, distinctly short of middle of third; media forking distinctly in front of cross vein, the base of posterior branch indistinct; cubitus forking below cross vein.

Length, 1.5 mm.

Type locality, Muncie, Ill., on bank of Stony Creek, July 5, 1914 (J. R. Malloch). Paratypes from Centerville, Ill., August 16, 1914 (J. R. Malloch).

This species is remarkably close to *polita* in color, and as the male of the latter in all probability has the claws of the tarsi subequal it is likely to be difficult to separate the males of the two species. The principal reason why I have accepted this as distinct from *polita* is because of the difference in venation. It is, I believe, a general rule that where the elongation of the third vein is unequal in the sexes, the greater elongation is in the female. Should the male described herewith prove ultimately to be that of *polita* it will be an exception to the rule. As indicated in the key to species, *æqualis* is also closely related to *caudelli.*

Female and early stages unknown.

8. Johannsenomyia caudelli Coquillett

Ceratopogon caudelli Coquillett, Jour. N. Y. Ent. Soc., Vol. 13, 1905, p. 63.
Johannseniella caudelli (Coquillett) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, p. 227.

This species I redescribed in an earlier article of this volume (Art. IV., p. 231). In addition to Havana and Algonquin, the Illinois localities already recorded, Mr. Hart and the writer have taken this species in great numbers in the pupal stage in the Little Wabash River at Carmi and in the Big Muddy River near Grand Tower. Adults have also been taken at St. Joseph, Dubois, and Carbondale. Pupal stage taken in April; adults, end of April and early part of May. I have seen three males taken by Professor Aldrich at Lafayette, Ind., May 2, 1914.

Ceratopogon flaviceps Johannsen may be a synonym, though I am unable to say definitely from the description.

9. Johannsenomyia macroneura, n. sp.

Female.—Brownish black, glossy. Face, flagellum of antennæ, palpi, and proboscis brownish yellow. Ventral surface of abdomen reddish. Legs brownish black, fore coxæ and trochanters and bases of all femora yellowish, all tarsi with the basal four joints whitish, the apical joint and claws black. Wings clear, veins yellowish. Halteres whitish.

Eyes separated by about one sixth the head-width; joints of basal half of flagellum distinctly but not greatly longer than broad; entire length of antennæ one and a third that of head and thorax together. Thoracic hairs short, rather stout and sparse. Legs stout, not elongate; hind tibiæ at apices as stout as femora; basal joint of hind tarsi about half as long as tibiæ; fifth joint without ventral spines; claws of fore and mid legs of moderate size, those of hind legs more elongate, each pair equal in size and with a tooth on inner sides. Third vein fused with costa before apex, extending almost to tip of wing; first vein ending at about one third the length of third; base of posterior branch of media obsolete; cubitus forking slightly before cross vein.

Length, 1.75 mm.

Type locality, Lawrence, Kansas.

Although this species closely resembles *æqualis* in many respects, I consider that the differences in color (especially that of the halteres) and venation are sufficient to justify me in describing them as different species. The media in *æqualis* forks distinctly in front of the cross vein, while in *macroneura* it forks at the cross vein. The base of the posterior branch of media is indistinct but traceable in both species.

The type specimen of *macroneura* was sent me by Prof. J. M. Aldrich, and is in the collection of this Laboratory.

10. Johannsenomyia magna Coquillett

Ceratopogon magnus Coquillett, Jour. N. Y. Ent. Soc., Vol. 13, 1905, p. 61.
Johannseniella magna (Coquillett) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, p. 227.

I have not seen this species. It was originally described from Texas. Male undescribed.

11. Johannsenomyia stigmalis Coquillett

Ceratopogon stigmalis Coquillett, Proc. U. S. Nat. Mus., Vol. 25, 1902, p. 86.
Johannseniella stigmalis (Coquillett) Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, p. 227.

I have not seen this species. It was originally described from Las Vegas Hot Springs, New Mexico. Male undescribed.

12. Johannsenomyia halteralis, n. sp.

Male.—Glossy black. Face, flagellum of antennæ and their plumes, and the palpi yellowish. Legs yellow, blackened on mid and hind coxæ, the hind femora, except their bases, and the whole of the hind tibiæ, apices of femora and bases of tibiæ of fore and mid legs brownish; apices of all tarsi blackened. Halteres with black knobs.

Eyes narrowly separated; antennæ reaching to middle of abdomen Disc of mesonotum covered with short closely placed brownish hairs. Abdomen slender; hypopygium very small, the apex of abdomen truncated and the hypopygium generally directed downward and closely adherent to surface of abdomen. Legs very slender and elongated, the posterior pair particularly so; basal joint of hind tarsus two-thirds as long as hind tibia and distinctly longer than remaining joints combined; fourth joint less than half as long as fifth; the latter with two pairs of blunt spines at middle, the fifth joint of fore and mid tarsi unspined; claws of fore and mid tarsi small, not a third as long as fifth joint; those of the hind tarsi about half as long as fifth joint. Third vein to three fourths the wing-length; first, short of middle of third; media forking before cross vein; cubitus forking below cross vein.

Female.—Glossy black. Face brownish yellow, palpi yellow. Base of abdomen yellow. Legs yellow, black on apical third of mid and hind femora and on the extreme apices of fore and mid tibiæ and the apical third of hind pair, and the last three tarsal joints of all legs also black.

Eyes narrowly separated; antenna slightly longer than head and thorax together. Hairs on mesonotum more sparse than in the male. Abdomen spatulate. Legs not as elongate as in male; basal joint of hind tarsus slightly more than half as long as hind tibia; fifth joint of all legs with 5–6 pairs of spines on under side; tarsal claws on all legs more than half as long as fifth joint, the hind pair the longest. Wings as in male.

Length, 2.5–3 mm.

Type locality, on banks of Sangamon River at Monticello, June 21–30, 1914 (J. R. Malloch). Paratypes from banks of Mackinaw River at Lilly, Ill., June 11, 1914 (C. A. Hart), and from banks of Stony Creek at Muncie, Ill., July 5, 1914 (J. R. Malloch).

I believe the female just described to be of this species, but I have no justification for this belief except the fact that both sexes were taken at the same time and place. The male is readily separated from *caudelli* by the much longer antennæ, the presence of the two pairs of spines on the under side of the fifth joint of the hind tarsi, and the elongate legs, the basal joint of the hind tarsus in *caudelli* being much thicker than in *halteralis* and barely more than half as long as the tibia. The female differs from that of *caudelli* in the more slender and longer antennæ, the pale color of the palpi and coxæ, and in having the legs more elongate, the basal joint of the hind tarsi being of equal thickness throughout its entire length, whereas in *caudelli* it is thickest at the base and tapers to the apex.

Hartomyia, n. gen.

This genus may be recognized by the following characters: antennæ elongated, the apical five joints conspicuously so, plumose on the basal eight joints of flagellum in male, short-haired throughout in female; mouth parts of female well developed, those of male less developed. Thorax with a series of distinct setulæ along the mesial and meso-lateral lines, and a group of similar setulæ in front of wing-base. Abdomen and legs similar to those of *Johannsenomyia*. Wings bare, the spurious Y-shaped vein present in the cell between radius and media; media forking very distinctly beyond the cross vein, i. e., petiolate; anal vein simple.

Separable from *Johannsenomyia* by the petiolate media.*

Type of genus, *Ceratopogon pictus* Coquillett.

*I have observed that *picta* and *antennalis* when at rest invariably have the wings spread in the form of an inverted V, whereas in the species of *Johannsenomyia* and other genera the wings are closed over the body. I have not, however, observed a sufficient number of species to enable me to decide whether the rule holds good for the species generally.

Key to Species

1. Wings with distinct black spots or bands....2
— Wings without spots or bands....3
2. Wings with 3 black spots or bands; male with fore and mid tarsal claws equal, the hind pair very unequal in length.... 1. *nebulosa.*
— Wings with 2 black spots (Pl. XXII, Fig. 11); male with claws of all tarsi subequal .... 2. *picta.*
3. Thorax yellow or green....4
— Thorax black 5
4. Thorax and abdomen green, the latter with a transverse pair of elongate black spots on segments 3 to 5; all tarsal claws unequal .... 3. *viridis.*
— Thorax and abdomen yellow, unspotted; all tarsal claws minute, subequal .... 4. *gilva.*
5. Small species, 1 mm.; third vein fused with first on its basal fourth; petiole of media slightly shorter than cross vein, tarsal claws minute, subequal .... 5. *arctica,* ♀.
— Larger species, 1.5 mm.; third vein connected with first by the normal cross-vein; petiole of media longer than cross vein; tarsal claws of female very unequal....6
6. Abdomen and halteres black; last joint of all tarsi with a transverse pair of blunt spines near base on ventral surface.. 6. *antennalis.*
— Abdomen and halteres pale 7
7. Abdomen green; last joint of all tarsi with a pair of spines near base on ventral surface.... 7. *diversa.*
— Abdomen yellow; last tarsal joint without spines.. 8. *pallidiventris.*

1. Hartomyia nebulosa Coquillett

Ceratopogon nebulosus Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 606.
Johannseniella nebulosa Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, Art. 4, 1914, p. 226.

This species is described by Coquillett as having the "thorax black, mesonotum opaque, densely gray pruinose and marked with large, mostly confluent spots and isolated brown dots; scutellum yellow, fore corners brown." The wings have three brown spots or bands as follows: "the first near center of basal cell, the second beginning at basal part of vein 3 and extending to apex of lower branch of fifth, the last beginning on costa beyond apex of vein 3, and extending into second posterior cell, also a small brownish spot near center of anal cell." The media forks slightly beyond the cross vein. Halteres white.

Length, 2 mm.

Originally described from a male taken in New Jersey. Has not been taken in Illinois to my knowledge. It probably occurs in this

state, as I have seen a male specimen taken by Professor Aldrich at Lafayette, Ind., July 6, 1914.

2. Hartomyia picta Coquillett

Ceratopogon pictus Coquillett, Jour. N. Y. Ent. Soc., Vol. 13, 1905, p. 60.

Male.—Bright green in life, dry specimens varying from green to yellow. Head yellow; antennæ darkened on apical half of flagellum, the plumes golden yellow on their basal half, black on apical half, palpi brown. Mesonotum glossy, anterior margin blackened on center, evidently a vestige of the central vitta, the meso-lateral vittæ glossy black, extending the entire length of disc: pleuræ with a dark brown mark extending from below wing-base to lower margin; center of scutellum suffused with dark brown, which sometimes extends to posterior portion of mesonotum; postnotum brown. Abdomen glossy pale green at base, the apical half with black marks on dorsum which sometimes consist of dorsal, lateral, and post-marginal stripes, leaving small enclosed pale spotlike areas, but occasionally the segments are almost entirely suffused with black. Legs yellow; mid coxæ brown; mid femora with a black spot on anterior side and another on posterior side near to apices, which sometimes fuse, forming a ring; hind femora with a black spot on the anterior surface at apical third, and the apices narrowly black; mid and hind tibiæ black at apices, the latter most distinctly so; tarsal claws black. Wings clear, veins brown, the cross vein, apex of radius, and a small spot immediately below the latter deep black (Pl. XXII, Fig. 11). Halteres yellow, sometimes brownish.

Eyes narrowly separated; antenna about one half longer than head and thorax combined, second joint large, globose, its dorsal surface with a few short black setulæ; joints of flagellum elongated, the last 5 conspicuously so; palpi short, the hairs sparse and black. Mesonotum without surface hairs, only the rows of setulæ present; scutellum with a group of 6 setulose hairs at apex and one or two on each side near base. Abdomen slightly spatulate at apex; hypopygium with the apical portion of the lateral arms slender, not recurved. Legs slender, surfaces with short blackish hairs, which are strongest on the dorsal surfaces of the mid and hind tibiæ; fore tibia with a distinct apical spine, no spine on other tibiæ; basal joint of fore tarsus twice as long as second and equal in length to the four apical joints combined; basal joint of middle tarsus about 2 1/3 times as long as second and distinctly longer than the combined length of the last 4; basal joint of hind tarsus twice as long as second and but little shorter than the combined length of the apical 4; fourth tarsal joint on all legs obcordate, much shorter than fifth; fifth without ventral spines; claws subequal, simple, the base but slightly produced. First vein extending half the

distance from humeral vein to wing-tip, third vein to two fifths of the distance from apex of first to wing-tip; distance from cross vein to apex of first, measured along costa, one third of that from apex of first to apex of third; last section of first vein little longer than the cross vein connecting it with third; the black spot on the posterior side of apex of third vein takes the form of a slight callosity of the wing membrane; petiole of media as long as the lower branch of cubitus, the latter forking in vertical lines with the apex of first vein and well beyond the cross vein.

Female.—Color as in the male but the black marks on the abdomen generally less coalescent, and those on the legs and wings more distinct.

The antennæ are much more slender than those of the male, and the joints more elongated, their combined length equaling two thirds the length of the body, surface hairs numerous, but short and weak; head as in male except that the proboscis is stronger. Abdomen stouter than that of male, the surface hairs weaker and paler. Legs similar to those of male, differing principally in having the fifth tarsal joint more elongate and with a transverse pair of bristles near its base on ventral side; tarsal claws unequal in size, the inner one being less than half as large as the outer. In other respects agrees with male.

Length, 2.5–3 mm.

Illinois localities: Urbana—a large series of specimens, representing both sexes in about equal numbers, taken by sweeping amongst undergrowth and trees on the banks of the old channel of Salt Fork at the fair grounds, May 20 and July 4, 1914; Monticello, June 28, and Mahomet, August 6, 1914, under same conditions as above (C. A. Hart and J. R. Malloch).

Originally described from Virginia. Male not hitherto described.

Palpomyia (Sphæromyas) bimacula Kieffer* agrees in almost every detail with the present species. The localities given for *bimacula* are Calcutta and N. Bengal. *P. viridiventris* Kieffer (l. c., p. 203) also belongs to this genus but is more closely allied to *viridis* Coquillett. The type locality for this species is Dawana Hills (1000 feet), Lower Burma.

3. Hartomyia viridis Coquillett.

Ceratopogon viridis Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 607.

Johannseniella viridis Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, Art. 4, 1914, p. 227.

Originally described from New Jersey. Has not been taken in Illinois.

* Mem. Ind. Mus., Vol. 2, 1910, p. 201.

4. Hartomyia gilva Coquillett

Ceratopogon gilvus Coquillett, Jour. N. Y. Ent. Soc., Vol. 13, 1905, p. 62.
Johannseniella gilva Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, Art. 4, 1914, p. 227.

Owing to a typographical error the length of the species is given in the original description as 8 mm. instead of 3 mm. I have seen a male specimen of this species, submitted by Prof. O. A. Johannsen, from Ithaca, N. Y., and another taken at Swarthmore, Pa., submitted by Mr. Cresson. The male agrees with the description of the female as given by Coquillett in being entirely yellow, in having the tarsal claws small and subequal, and in venation. The antenna is one and a half times as long as head and thorax together, the plumes are yellow with brownish apices, and the legs have many long setulose surface hairs. A female from Polk Co., Wis. (Aldrich), has the setulose hairs on the legs weaker than those of the male.

Originally described from three females taken at Biscayne Bay, Florida, by Mrs. A. T. Slosson. The species probably occurs in Illinois.

5. Hartomyia arctica Coquillett

Ceratopogon arcticus Coquillett, Proc. Wash. Acad. Sci., Vol. 2, 1900, p. 396.
Johannseniella arctica Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, Art. 4, 1914, p. 227.

I have not seen this species. It was originally described from Alaska and has not been subsequently recorded. I have some doubt as to its generic position, and have included it in the key given for species of *Johannseniomyia* as well as in the key to species of the present genus.

6. Hartomyia antennalis Coquillett

Ceratopogon antennalis Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 606.
Johannseniella antennalis Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, Art. 4, 1914, p. 227.

Male.—Glossy black. Abdomen generally yellowish at base. Legs yellow, mid and hind legs, with the coxæ and femora, except bases, black. Knob of halteres black. Antennal plumes brown; body bristles black.

Eyes contiguous; antennæ reaching to middle of abdomen. Thoracic hairs weak. Hypopygium barely longer than last abdominal segment. Legs slender, basal joint of tarsi longer than the other joints combined; fifth joint without ventral spines; claws small, simple, equal. Third vein to about three fourths the wing-length; first about one

fourth the length of third; media forking beyond end of first vein; cubitus forking below end of first vein.

Female.—Agrees in coloration with the male. Differs from the male in having the antennæ with short white hairs, the fifth tarsal joint with a transverse pair of bristles near base on ventral surface, and the tarsal claws on all legs very unequal, the outer one being about three times as long as the inner. Otherwise as male.

Length, 1.5 mm.

Illinois localities: Urbana, Mahomet, and Monticello, June 30 to August 6, 1914; swept from vegetation along banks of streams (C. A. Hart and J. R. Malloch).

Originally described from the District of Columbia. Male not hitherto described. I have seen three females taken at Lafayette, Ind., by Professor Aldrich on June 1, August 5 and 15, 1914.

7. Hartomyia diversa Coquillett

Ceratopogon diversus Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 607.
Johannseniella diversa Malloch, Bull. Ill. State Lab. Nat. Hist., Vol. 10, Art. 4, 1914, p. 227.

I have not seen this species. It is described by Coquillett as differing from *antennalis* in having the abdomen green, and the legs entirely light yellow.

Originally described from New Jersey.

8. Hartomyia pallidiventris, n. sp.

Female.—Black, shining. Head, including antennæ, palpi, and proboscis, yellow. Abdomen yellowish, white in life. Legs entirely yellow. Halteres white.

Eyes contiguous, antenna as long as entire body. Hairs on thorax weak. Abdomen ovate, very stout. Legs slender; basal joint of tarsi longer than the remaining joints together; fifth joint without distinguishable ventral spines; outer tarsal claw very long and slender, the inner particularly slender and about half as long as outer. Third vein reaching beyond three fourths the wing length; first, to one fifth the length of third; media forking distinctly beyond apex of first vein; furcation of cubitus slightly proximad of that of media.

Length, 1 mm.

Type locality, Urbana, Ill., May 20, 1914, swept from vegetation along the bank of Salt Fork at the fair grounds (J. R. Malloch).

A female taken by Professor Aldrich at Lafayette, Ind., July 25, 1914, differs from the type in having the dorsum of the abdomen darkened.

Coquillett's description of *diversa* is not very satisfactory, but the points of difference between it and *pallidiventris* are quite sufficient to warrant me in concluding that the species just described is not the same as *diversa*.

Bezzia Kieffer

This genus is separable from *Palpomyia* by the absence of the cross vein which in that genus connects the first and third veins.

The only species which has been reared from the larva is *setulosa* Loew. A description of the early stages of this species is given by Johannsen in Bulletin 86 of the New York State Museum, 1905, p. 102, and a brief description of all the stages is given herewith. The habits of the adult are unknown.

Key to Species

1. Wings with 2 black spots ..... 1. *punctipennis.*
— Wings unspotted 2
2. Only the fore femora with spines 3
— At least the fore and hind femora spinose 9
3. Halteres black 4
— Halteres pale, rarely brownish 6
4. Mesonotum black, with dense gray pruinescence; scutellum yellow; legs mostly yellow; fore femora with a pair of widely separated spines on ventral surface ..... 2. *cockerelli.*
— Mesonotum glossy black, not distinctly pruinescent; legs mostly black; fore femora with more than 2 spines on ventral surface ... 5
5. Claws simple; antennæ brown, if turned back reaching to middle of mesonotum ..... 3. *venustula.*
— Claws with central tooth on inner side; antennæ exceeding length of head and thorax combined ..... 4. *flavitarsis.*
6. Hind tibiæ with distinct bristles; legs black, tarsi except the narrow apices of joints, a ring before apices of fore femora, and both ends of fore and mid tibiæ except their extreme apices yellow; abdomen black ..... 5. *media.*
— Hind tibiæ without bristles; legs not colored as above 7
7. Abdomen black ..... 6. *pruinosa.*
— Abdomen partly yellow 8
8. Abdomen pale yellow, dorsum of first segment brown; legs yellow, coxæ, a band before apices of fore and mid femora, and one near base of fore and hind tibiæ, and hind femora except extreme bases black ..... 7. *varicolor.*
— Basal half of abdomen pale yellow, apical half blackened; legs yel-

low, coxæ, extreme bases of hind femora, a band beyond middle of fore and mid femora and their extreme apices, the apical fourth of hind femora, a band on basal half of fore tibiæ and the narrow apices of all tibiæ blackened.....8. *apicata.*

9. All femora with 1 spine.....9. *barberi.*
— At least fore and hind femora with more than one spine.....10
10. Halteres black or brown 11
— Halteres white or yellow 13
11. Mesonotum brown, with dense gray pruinescence, a brown median vitta on anterior half and a transverse row of brown spots at middle; scutellum yellow.....10. *pulverea.*
— Mesonotum and scutellum black 12
12. All femora spinose on almost their entire length; mesonotum opaque .....11. *johnsoni.*
— Mid femora generally devoid of spines, the other pairs spined on apical half; mesonotum with 3 glossy vittæ, the remaining portions with distinct white pruinescence.....12. *dentata.*
13. Abdomen white or yellowish, sometimes fuscous-tinged; fifth tarsal joint unspined 14
— Abdomen black; fifth tarsal joint with distinct ventral spines..... .....13. *setipes.*
14. Mid and hind legs with their femora and tibiæ entirely black..... .....14. *albidorsata.*
— Mid and hind legs pale yellow, their bases and apices blackened.... .....15. *setulosa.*

1. Bezzia punctipennis Williston

Ceratopogon punctipennis Williston, Trans. Ent. Soc. Lond., 1896, p. 278.
Bezzia punctipennis (Williston) Malloch, Jour. N. Y. Ent. Soc., Vol. 22, 1914, p. 282.

Described from St. Vincent, British West Indies, and not subsequently recorded.

2. Bezzia cockerelli, n. sp.

Female.—Brownish black, slightly shining. Head black, face yellowish brown, basal 2 joints of antennæ black, the flagellum missing. Thorax with dense yellowish pruinescence almost obscuring the ground color; scutellum yellow. Abdomen distinctly shining, not pruinescent. Legs yellow, coxæ, trochanters, fore and mid knees, apices of hind femora and the narrow apices of all tibiæ and of the basal two tarsal joints blackish brown, apical three tarsal joints black. Wings clear, veins yellow. Halteres dark brown.

Eyes separated by about one sixth the head-width. Mesonotum with microscopic closely placed black hairs on disc, each of which is set

in a minute puncture; in front of wing-base a group of 8–10 stout black setulæ; scutellum with about six marginal setulæ, disc with many microscopic hairs. Abdomen almost parallel-sided, the surface with very weak hairs. Legs strong, fore femora slightly stouter than hind pair, one stout thornlike bristle at middle on ventral surface and another midway between it and the apex; other femora unspined; hind tibiæ without strong hairs; basal joint of hind tarsi as long as next three together; fifth joint twice as long as fourth, without ventral bristles; claws rather short, equal in length, and with a small median inner tooth. Third vein to three fourths the wing-length, first to two fifths the length of third; media forking at cross vein; cubitus forking almost directly below cross vein.

Length, 3 mm.

Type locality, Modern, Col., May 28 (T. D. A. Cockerell). Named in honor of the captor.

This species has not been taken in Illinois.

3. Bezzia venustula Williston

Ceratopogon venustulus Williston, Trans. Ent. Soc. Lond., 1896, p. 278.
Bezzia venustula (Williston) Malloch, Jour. N. Y. Ent. Soc., Vol. 22, p. 282.

Described from St. Vincent, British West Indies, and not subsequently recorded.

4. Bezzia flavitarsis Malloch

Bezzia flavitarsis Malloch, Jour. N. Y. Ent. Soc., Vol. 22, 1914, p. 283.

This species while almost the same in color as *dentata* Malloch is readily separated from it by the different bristling on the legs and by the venation. In *flavitarsis* there are 4–5 spines on the apical half of the ventral surface of the fore femora only, the other pairs being nude except for a short spine at the apex on the anterior surface. The tibial bristles are also much less numerous and less conspicuous than in *dentata*. The third vein extends to less than three fourths the wing-length.

Originally described by the writer from female specimens obtained at Monticello, Ill., June 21, 1914, on the bank of Sangamon River. In addition to this locality, specimens have since been obtained in Illinois by the writer at Muncie, July 5. Mr. Hart collected specimens, July 15, 1914, from two Michigan localities, namely, Little Bear Lake at Grand Junction, and South Haven.

At Little Bear Lake Mr. Hart took a single male specimen. It differs from the female in having the flagellum of the antennæ yellow except on the apical third, the antennal plumes golden yellow, the entire length of antenna nearly twice that of head and thorax combined, the tibiæ more strongly setulose, the third vein to about two thirds the wing-length, and the first to middle of third.

5. Bezzia media Coquillett

Ceratopogon medius Coquillett, Proc. Ent. Soc. Wash., Vol. 6, 1904, p. 166.
Bezzia media (Coquillett) Malloch, Jour. N. Y. Ent. Soc., Vol. 22, 1914, p. 282.

Originally described from New Jersey. Male undescribed. Has not been taken in Illinois.

6. Bezzia pruinosa Coquillett

Ceratopogon pruinosus Coquillett, Jour. N. Y. Ent. Soc. Vol. 13, 1905, p. 59.
Bezzia pruinosa (Coquillett) Malloch, Jour. N. Y. Ent. Soc., Vol. 22, 1914, p. 282.

I have not seen this species.

Originally described from a female specimen collected at Bear Lake, B. C.

7. Bezzia varicolor Coquillett

Ceratopogon varicolor Coquillett, Ent. News, Vol. 13, 1902, p. 84.
Bezzia varicolor (Coquillett) Malloch, Jour. N. Y. Ent. Soc., Vol. 22, 1914, p. 282.

Originally described from Long Island, N. Y. Male undescribed. Has not been taken in Illinois.

8. Bezzia apicata Malloch

Bezzia apicata Malloch, Jour. N. Y. Ent. Soc., Vol. 22, 1914, p. 284.

Originally described by the writer from a single male obtained at Muncie, Ill., May 24, 1914. No further material has been obtained.

The female probably differs considerably in structure from the male, but if the general rule for the group holds good in this species the abdomen should be entirely white and the legs should be less conspicuously blackened.

9. Bezzia barberi Coquillett

Ceratopogon barberi Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 601.
Bezzia barberi (Coquillett) Malloch, Jour. N. Y. Ent. Soc., Vol. 22, 1914, p. 282.

Originally described from Chesapeake Beach, Md. Male undescribed. Has not been taken in Illinois.

10. Bezzia pulverea Coquillett

Ceratopogon pulvereus Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 600.
Bezzia pulverea (Coquillett) Malloch, Jour. N. Y. Ent. Soc., Vol. 22, 1914, p. 283.

Originally described from New Jersey and the District of Columbia. Male undescribed. Has not been taken in Illinois.

11. Bezzia johnsoni Coquillett

Ceratopogon johnsoni Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 600.
Bezzia johnsoni (Coquillett) Malloch, Jour. N. Y. Ent. Soc., Vol. 22, 1914, p. 282.

Originally described from New Jersey. Male undescribed. Has not been taken in Illinois.

12. Bezzia dentata Malloch

Bezzia dentata Malloch, Jour. N. Y. Ent. Soc., Vol. 22, 1914, p. 284.

This species is very close to the description of *johnsoni,* but the characters given in the key should serve to separate the two. Coquillett states in his description of *johnsoni* that one claw on each tarsus has a median tooth, whereas in *dentata* both claws have this tooth. The male has both tarsal claws simple.

Originally described from Monticello, Ill., by the writer. Dates of occurrence, June 21–28. A male was obtained on the bank of Salt Fork at Urbana, Ill., July 4, 1914, by the writer.

13. Bezzia setipes Coquillett

Ceratopogon setipes Coquillett, Jour. N. Y. Ent. Soc., Vol. 13, 1905, p. 59.
Bezzia setipes (Coquillett) Malloch, Jour. N. Y. Ent. Soc. Vol. 22, 1914, p. 282.

Originally described from Brownsville, Texas. Male undescribed. Has not been taken in Illinois.

14. Bezzia albidorsata, n. sp.

Female.—Black, slightly shining. Antennæ brown, the bases of the short flagellar joints yellow. Mesonotum deep black, the disc with conspicuous white pruinescence which is so distributed that the disc has on the anterior half a black divided median vitta, laterally on the posterior half a large V-shaped mark of same color with its narrow extremity on posterior margin, and a curved black spot covering the anterior dorso-lateral depressions; pleuræ and scutellum slightly shining, with slight pruinescence. Dorsal surface of abdomen covered with a dense whitish pile which is so short as to appear like pruinescence, and so dense that the abdomen appears whitish or yellowish except on apical segment; venter fuscous. Legs glossy black, fore femora with an obscure yellow band at apices, fore tibiæ with a similar band near bases and another near apices; tarsi pale yellow, the apices of the joints narrowly blackened. Wings clear. Halteres whitish.

Eyes separated by about one sixth the width of head; antenna equal in length to head and thorax together. Mesonotum with the discal hairs short and setulose. Abdomen narrow, slightly widest before middle. Legs strong; fore femora with 4–5 ventral spines; hind femora

with one spine, tibiæ with rather strong bristles; basal joint of hind tarsi shorter than remaining joints together; fifth joint without ventral spines; claws rather small, subequal, each with an inner median tooth. Third vein to about three fourths the wing-length, first short of middle of third; cross vein distinctly before wing-middle and slightly in front of fork of cubitus.

Length, 3. mm.

Type locality, Algonquin, Ill., July 12, 1895 (W. A. Nason). Paratype from Wallops Island, Va., May 25, 1913 (W. L. McAtee).

Should the spine on hind femora be overlooked or absent this species will run down to *media* in the foregoing key, from which the whitish abdomen readily separates it.

15. Bezzia setulosa Loew

Ceratopogon setulosus Loew, Berl. Ent. Zeitschr., 1861, p. 312, sp. 8.
Bezzia setulosa (Loew) Malloch, Jour. N. Y. Ent. Soc., Vol. 22, 1914, p. 282.

Larva.—Length, 6–7 mm. White. Head brownish, eye spot duplicated, black; dorsal surface with a few weak hairs. Mandibles without distinct teeth, the apical half slender, curved, the basal half thickened, the general shape similar to that of *Palpomyia longipennis;* labium produced anteriorly at center in the form of a rather sharp simple tooth. Abdomen as in *longipennis.*

Pupa.—Length, 3.5 mm. Brownish. Thoracic respiratory organ about five times as long as wide, of almost the same width throughout, the surface with a few inconspicuous hairs, trachea filling almost the entire area, without decided convolutions; dorsum of thorax on the anterior half with minute granulations, and a group of five weak hairs on each side at middle. First abdominal segment with about five weak hairs on dorsum, the succeeding segments, viewed from the side, with about twelve small tubercles, three of which, in a perpendicular row beyond the middle, are the most distinct, each tubercle armed at the apex with a hair. (Apical segment broken.)

Imago; Male.—Black. Antennal plumes golden yellow. Thorax covered with dense pruinescence, the disc of mesonotum with a brown anterior divided median vitta which reaches beyond middle, and a lateral streak of same color which reaches from posterior margin to middle; scutellum yellow, often brownish. Abdomen yellowish white, the apical 2–3 segments tinged with fuscous. Legs pale yellow, coxæ black, the bases of all femora, a ring before apices of fore femora, the apical third of mid and hind femora, a ring beyond base of fore tibiæ, the basal third of mid and hind pairs, and narrow apices of all tibiæ and the apices of the tarsal joints black. Wings clear, veins yellow. Halteres yellow.

Eyes narrowly separated; antenna nearly twice as long as head and thorax together. Mesonotum with numerous discal hairs which

are arranged regularly over the entire surface; from in front of wing-base to scutellum, on lateral margins, there is a series of distinct black setulos hairs; scutellum with six strong marginal hairs. Abdomen slender, rather densely covered with short black hairs; hypopygium small. Legs slender; fore femora with 4–6, mid and hind femora with 1–2, spines each; femora and tibiæ with the surface setulose; fifth tarsal joint unspined; claws small, equal, simple. Third vein slightly more than to two thirds the wing-length; first, slightly short of middle of third; cubitus forking slightly beyond cross vein.

Female.—Differs from the male in having the antennæ short-haired, their entire length equal to about one and a half times that of head and thorax combined; the larval claws larger, and each with an inner median tooth, and the third vein to almost three fourths the wing-length.

Length, 3 mm.

Illinois localities: Urbana, St. Joseph, Mahomet, Muncie, Monticello, Havana, Normal, Dubois, and Grand Tower. Dates of occurrence range from April to August. It is the commonest species of the genus.

The writer succeeded in rearing a female from a larva obtained from Salt Fork at St. Joseph, April 5, 1914.

Originally described from the District of Columbia by Loew, and subsequently recorded from New Jersey and New York. Professor Johannsen reared the species, and figures details of the larva and pupa.*

I have seen a male and female of this species taken by Professor Aldrich at Moscow, Idaho, the former on parsnip flowers, July 2, 1912, and the latter August 23, 1912.

Pseudobezzia, n. gen.

This genus is distinguished from *Bezzia* by the petiolate media. In other respects the two genera agree.

Type of genus, *Ceratopogon expolitus* Coquillett.

Pseudobezzia expolita Coquillett

Ceratopogon expolitus Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1903, p. 600.
Bezzia expolita (Coquillett) Malloch, Jour. N. Y. Ent. Soc., Vol. 22, 1914, p. 282.

This species is described by Coquillett as having the fore femora with two spines on the apical half of the ventral surface, the basal joint

*Bull. 86, N. Y. State Mus., 1905, Pl. 18, Figs. 4–6, 9–12.

of hind tarsi almost twice as long as second, the fifth joint without spines, and the larval claws simple and about half as long as fifth tarsal joint. The head, mesonotum, and scutellum are black, pleuræ, abdomen, and halteres brown. The legs are dark brown, the base and a ring before apices of mid tibiæ, tarsi except apices of joints, and fore femora wholly yellow.

Length, 2 mm.

Originally described from a male specimen obtained at Riverton, N. J. It has not been taken in Illinois.

Probezzia Kieffer

The species of this genus are separable from those of *Bezzia* by the absence of the femoral spines, and from those of *Parabezzia* by the sessile media. In a recent paper* dealing with the species of this genus I included *elegantula* Johannsen and *inermis* Coquillett, both of which I have since placed in *Parabezzia*, together with a new species described in the present paper.

None of the species of this genus have been described in the early stages, and the habits of the adults are unrecorded. It is safe to assume, however, that the larvæ are aquatic, as in allied genera, the adults of Illinois species having generally been taken near streams, by sweeping vegetation or, in the evenings, at light.

Key to Species

1. Apex of wing brown; third vein almost nine tenths the wing-length ..... 1 *terminalis.*
— Wings clear or only slightly infuscated 2
2. Whitish or yellowish species 3
— Black or fuscous species 4
3. Fulvous species; eyes widely separated; antenna not as long as head and thorax combined; fifth tarsal joint not spinose ventrally; third vein four fifths the wing-length ..... 2. *fulvithorax.*
— Yellowish white species; eyes narrowly separated; antenna 1½ times as long as head and thorax combined; legs whitish; fifth tarsal joint black, with 2 rows of long spines on ventral surface; third vein almost to apex of wing ..... 3. *pallida.*
4. Scutellum yellow, noticeably paler than mesonotum 5
— Scutellum not paler than disc of mesonotum or posnotum 7
5. Mesonotum covered with pale pruinescence and with a brown central vitta ..... 4. *glaber.*
— Mesonotum not vittate 6
6. Scutellum reddish yellow, shining black at base; abdomen light yel-

*Proc. Biol. Soc. Wash., Vol. 27, 1914, p. 137.

low, first segment black, tip brown; length 3.75 mm..... ..... 5. *pachymera.*

— Scutellum unicolorous brownish yellow; abdomen brown, paler on dorsum; length 2.5 mm. ..... 6. *obscura.*

7. Fifth joint of hind tarsus spinose ventrally.....8

— Fifth joint of hind tarsus unspined.....10

8. Knob of halteres black, stem yellow; abdomen white; legs black, bases of tarsi white ..... 7. *albiventris.*

— Knob of halteres yellow or white.....9

9. Thorax glossy black; abdomen white; legs whitish yellow, apical half of all femora, apices of hind tibiæ, and last tarsal joint of all legs black; wings whitish, veins colorless..... 8. *elegans,* ♀.

— Thorax glossy black; abdomen greenish white, the dorsum blackened except base; legs black, yellow on apices of coxæ, trochanters, and bases of femora, basal four tarsal joints whitish; wings slightly infuscated on anterior half from before cross vein almost to apex, the veins on that portion, including anterior branch of media, dark brown ..... 9. *smithi.*

10. Mesonotum opaque pale fuscous; slightly gray pruinose. 10. *opaca.*

— Mesonotum glossy black or distinctly shining, with pruinescence obscuring the disc in part.....11

11. Mesonotum with 2 whitish pruinose vittæ; legs black, bases of tarsal joints yellowish..... 11. *bivittata.*

— Mesonotum without whitish vittæ; legs with more than bases of tarsal joints yellow 12

12. Abdomen wholly black.....13

— Abdomen pale at base.....14

13. Legs black, a yellow band before apices of fore femora, another one near apices of fore and mid tibiæ, and the tarsi yellow; body highly polished ..... 12. *gibber.*

— Legs yellow; coxæ, apices of hind femora, hind tibiæ except bases, and whole of hind tarsi dark brown; body only slightly shining; mesonotum distinctly pruinose ..... 13. *incerta.*

14. Legs yellow, apical half of all femora, extreme bases of all tibiæ, apices of hind tibiæ (rather broadly) and those of fore and mid pairs (narrowly), and last tarsal joint, blackened.. 8. *elegans,* ♂.

— Legs yellow, knees, apices of tibiæ, and whole of last tarsal joint of all legs blackened ..... 14. *flavonigra.*

1. Probezzia terminalis Coquillett

Ceratopogon terminalis Coquillett, Proc. Ent. Soc. Wash., 1904, p. 90.

Probezzia terminalis (Coquillett) Malloch, Proc. Biol. Soc. Wash., Vol. 27, 1914, p. 137.

I have not seen this species. It was described from a female taken in Nicaragua. It is highly improbable that it occurs in Illinois.

2. Probezzia fulvithorax, n. sp.

Female.—Fulvous, slightly shining. Head brown on vertex; antennæ fuscous; face and palpi pale fulvous. Disc of mesonotum subopaque, with very slight indications of pale pruinescence; pleuræ shining. Abdomen slightly brownish, shining. Legs, including the coxæ, pale reddish yellow; knees of hind legs narrowly dark brown, apical 2 joints of tarsi slightly brownish. Wings clear, veins yellow. Halteres fulvous.

Eyes separated by about a fifth the width of head; antenna about as long as head and thorax combined, second joint of flagellum very slightly longer than its diameter, the other joints becoming successively longer to the eighth, apical 5 about 4 times as long as broad. Mesonotum covered with very short closely placed hairs, the usual longitudinal rows of hairs almost indistinguishable; 4–5 black setulose hairs in front of each wing-base; scutellum with a few marginal setulose hairs. Abdomen slender, not noticeably spatulate, the apical segment very little broadened. Legs slender, without setulæ, hind tibial hairs weak; basal joint of hind tarsi slightly longer than the next 3 joints together; fifth joint without ventral spines; tarsal claws rather small, subequal, each with a short tooth near base on inner side. Third vein to five sixths the wing-length; first, to two fifths the length of third; media forking slightly before cross vein; cubitus forking below cross vein.

Male.—Slightly darker in color than the female. Antennal plumes brown.

Length of antenna slightly exceeding that of head and thorax together. Hypopygium small. Legs as in female except that the tarsal claws are distinctly smaller in comparison with the fifth joint. Third vein to two thirds the wing-length; first, to near middle of third. Otherwise as female.

Length: female, 2.5 mm.; male, 1.5 mm.

Type locality, Urbana, Ill., July 7, 1914, on store windows in town after the lights were turned on (C. A. Hart and J. R. Malloch). Mr. Hart obtained 2 females at Little Bear Lake, Columbia, Mich., July 15, 1914.

3. Probezzia pallida Malloch

Probezzia pallida Malloch, Proc. Biol. Soc. Wash., Vol. 27, 1914, p. 138.

This species was described from the female only, and I have not yet been able to obtain the male. Muncie and Monticello, Ill., are the only localities from which I have seen this species, and June 28 is the latest date on which it was collected.

It is easily distinguished from any described species in this genus by its extremely pale color, and by the conspicuously spinose black fifth tarsal joint of all the legs.

4. Probezzia glaber Coquillett

Ceratopogon glaber Coquillett, Proc. U. S. Nat. Mus., Vol. 25, 1902, p. 85.
Probezzia glaber (Coquillett) Malloch, Proc. Biol. Soc. Wash., Vol. 27, p. 137.

This species was described by Coquillett from a female specimen from Florida, and that sex only is represented in the collection before me. The legs are pale yellow, all coxæ, trochanters, a narrow spot beyond middle on anterior side of fore femora, a narrow median band on fore tibiæ, and the narrow apices of all tibiæ and of the tarsal joints black. Tarsal claws of fore and mid legs of moderate size, those of hind pair almost as long as fifth joint, subequal. Wing as in Figure 9, Plate XXII.

Illinois localities: Havana, Peoria, and Urbana. April 30 to July 7. Collected by C. A. Hart and the writer.

5. Probezzia pachymera Williston

Ceratopogon pachymerus Williston, Biol. Cent. Amer., Supp., p. 224.
Probezzia pachymera (Williston) Malloch, Proc. Biol. Soc. Wash., Vol. 27, 1914, p. 137.

Described from Vera Cruz, Mexico.

6. Probezzia obscura, n. sp.

Female.—Brown, slightly shining. Antennæ pale brown. Mesonotum slightly pruinescent on lateral margins and at the limit of its anterior third, on each side; scutellum brownish yellow. Abdomen brown, yellowish on basal half of dorsum. Legs yellow, hind femora gradually becoming blackened from middle to apex; apices of tibiæ narrowly blackened; apices of tarsi brown. Halteres brown. Wings clear, veins yellow.

Eyes separated by about one fifth the head-width; second joint of flagellum of antenna slightly more than twice as long as broad. (Antennæ broken.) Disc of mesonotum covered with very closely placed, short and rather stout, blackish hairs; the group of bristles in front of wing-base numbers 6–7; scutellum bristles strong but not numerous. Abdomen slender, slightly broadest at second segment. Legs stronger than in *fulvithorax;* basal joint of hind tarsus nearly as long as the remaining joints combined; fifth joint without ven-

tral spines; tarsal claws equal, rather small, those of hind tarsi not more than half as long as fifth joint, no distinguishable tooth on inner side of claws. Third vein to slightly more than two thirds the wing-length; first, to about three sevenths the length of third; media forking at cross vein; forking of cubitus appreciably beyond cross vein.

Length, 2.5 mm.

Type locality, Ithaca, N. Y., July 15, 1901 (O. A. Johannsen).

7. Probezzia albiventris Loew

Ceratopogon albiventris Loew, Berl. Ent. Zeitschr., 1861, p. 311, sp. 7.
Probezzia albiventris (Loew) Malloch, Proc. Biol. Soc. Wash., Vol. 27, p. 318.

I have taken only a single female specimen of this species,—Urbana, Ill., July 7, 1914, at light, on store window in town.

The antennæ are whitish yellow, darkened apically, and extended backward would reach to middle of abdomen. The basal joint of hind tarsus is slightly longer than the remaining joints combined; the fifth joint has two rows of ventral spines; and the tarsal claws are long, subequal, and have a distinct subbasal tooth. Third vein almost to wing-tip; first, short of middle of third; media and cubitus both fork before cross vein, the latter but slightly before it.

Length, 3 mm.

Originally described from Georgia, and subsequently recorded from New Jersey by Smith. The male is undescribed.

8. Probezzia elegans Coquillett

Ceratopogon elegans Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 599.
Probezzia elegans (Coquillett) Malloch, Proc. Biol. Soc. Wash., Vol. 27, p. 138.

The female of this species differs from the female of *albiventris* in color as indicated in the key. In addition to this color difference the antennæ are comparatively shorter, the hairs on the disc of the mesonotum are more sparse and distinctly setulose, and the insect is more slender and slightly smaller, being rarely over 2.5 mm. in length.

The male differs from the female in the absence of the spines on the ventral surface of the fifth tarsal joint; in having the antennæ with long yellowish plumes and the antennal length one and a half times that of head and thorax combined; also in venation, the third vein extending to about three fourths of the wing-length, and the first extending to middle of third.

Length, 1.5 mm.

Illinois localities: Muncie, May 24, 1914; Monticello, June 28, 1914,—(J. R. Malloch). Taken by sweeping amongst vegetation

alongside streams. I have seen a specimen which was taken on Plummer's Island, Md., May 8, 1914, by W. L. McAtee.

Originally described from a female taken at Riverton, N. J.

9. Probezzia smithi Coquillett

Ceratopogon smithii Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 600.
Probezzia smithi (Coquillett) Malloch, Proc. Biol. Soc. Wash., Vol. 27, p. 138.

Differs from *elegans* in color as indicated in table. There are no outstanding structural differences in the two species.

Illinois locality, Monticello, June 28, 1914 (J. R. Malloch). Taken by sweeping vegetation along the banks of the Sangamon River.

The male is unknown.

10. Probezzia opaca Loew

Ceratopogon opacus Loew, Berl. Ent. Zeitschr., 1861, p. 312, sp. 9.
Probezzia opaca (Loew) Malloch, Proc. Biol. Soc. Wash., Vol. 27, p. 138.

I have not seen this species. It is structurally close to *incerta*, *fulvithorax*, and *obscura*. Described from Washington, D. C., and not subsequently recorded.

Mr. C. W. Johnson has kindly examined the type specimen in Cambridge and reports that it is light brown, eyes apparently separated, although the head is greatly shrunken. Antennæ about as long as thorax. Legs light yellow, very narrowly darkened at the tips of the femora, tibiæ, and tarsal joints. Mr. Johnson's sketch of the wing shows the first vein extending to less than one fifth the length of third, but otherwise similar to *fulvithorax*.

11. Probezzia bivittata Coquillett

Ceratopogon bivittatus Coquillett, Jour. N. Y. Ent. Soc., Vol. 13, 1905, p. 60.
Probezzia bivittata (Coquillett) Malloch, Proc. Biol. Soc. Wash., Vol. 27, p. 138.

I have not seen this species. It was originally described from Eureka, Calif. The male is unknown.

12. Probezzia gibber Coquillett

Ceratopogon gibber Coquillett, Jour. N. Y. Ent. Soc., Vol. 13, 1905, p. 60.
Probezzia gibber (Coquillett) Malloch, Proc. Biol. Soc. Wash., Vol. 27, p. 138.

I have not seen this species. Originally described from Cayamas, Cuba. The male is unknown.

13. Probezzia incerta, n. sp.

Female.—Black, slightly shining. Antennæ fuscous, basal half of flagellum yellowish. Mesonotum with slight whitish pruinescence, which is most distinct near lateral anterior angles; pleuræ with slight grayish pruinescence. Abdomen shining black, the surface with very slight grayish pruinescence. Legs yellow, coxæ, apices of hind femora, hind tibiæ except their bases, and whole of hind tarsi dark brown. Wings clear, veins yellow. Halteres brownish yellow.

Eyes separated by less than one sixth the width of head; antennæ one and a half times as long as head and thorax together, second joint of flagellum about four times as long as its diameter. Mesonotum with very short, closely placed, black setulose hairs; 2–3 rather weak setulæ in front of wing-base. Abdomen broadest at second segment. Legs similar to those of *fulvithorax,* but the hind tarsi are thicker and the claws comparatively much smaller, and simple. Third vein to four fifths the wing-length; first, to two fifths the length of third; media forking at cross vein; cubitus forking distinctly beyond it.

Length, 2.5 mm.

Type locality, Monticello, Ill., June 21–30 (J. R. Malloch). Taken by sweeping vegetation along the bank of the Sangamon River.

14. Probezzia flavonigra Coquillett

Ceratopogon flavoniger Coquillett, Jour. N. Y. Ent. Soc., Vol. 13, 1905, p. 60.
Probezzia flavonigra (Coquillett) Malloch, Proc. Biol. Soc. Wash., Vol. 27, p. 138.

This species, if distinct, must be very close to the male of *elegans.* Coquillett described the species from a male taken at Bear Lake, B. C., and no subsequent captures are recorded. The only distinctions between the descriptions of *flavonigra* and *elegans* are given in the foregoing key to the species.

Parabezzia, n. gen.

The species of this genus are separable from those of *Probezzia* by the petiolate media. In *Probezzia* the media forks either at or before the cross vein.

Type of genus, *Parabezzia petiolata,* n. sp.

Key to Species

1. Glossy black species; third vein less than to two thirds the wing-length .....1. *petiolata.*
— Opaque black species with yellow scutellum, or entirely yellow species; third vein more than to two thirds the wing-length.....2

2. Yellow species; third vein to three fourths the wing-length; legs yellow, apices of hind femora, bases of hind tibiæ, and apices of all tibiæ and of all tarsi blackened..... 2. *elegantula.*
— Opaque black species; scutellum, halteres, and tarsi yellow; third vein to five sixths the wing-length.....3. *inermis.*

1. Parabezzia petiolata, n. sp.

Male.—Glossy black. Legs black, tarsi almost entirely whitish yellow. Wings clear, veins almost colorless. Halteres white, Antennal plumes brownish, whitish at apex; body hairs and setulæ black.

Eyes distinctly separated; antennæ about one and a half times as long as head and thorax combined. Disc of mesonotum unpunctured and without any pruinescence, the discal hairs strong, setulose, confined to the median and submedian lines and the lateral margins; scutellum with 6–8 setulose marginal hairs. Abdomen subcylindrical, nearly bare; hypopygium small. Legs slender, hind tibiæ with inconspicuous dorsal setulose hairs; basal joint of hind tarsus slightly more than half as long as tibia and as long as remaining joints together; fifth joint without ventral spines; tarsal claws of moderate size, subequal. Third vein distinctly short of two thirds the wing-length, joining costa at an acute angle; first vein almost connected with third at its base, joining costa slightly beyond middle of third; apex of petiole of media slightly before apex of first vein; base of posterior branch of media indistinct; fork of cubitus in line with fork of media.

Length, 1.25–1.5 mm.

Type locality, Muncie, Ill., May 24 and July 5, 1914 (C. A. Hart and J. R. Malloch).

The female and early stages are unknown.

2. Parabezzia elegantula Johannsen

Ceratopogon elegantulus Johannsen, Kans. Univ. Sci. Bull., Vol. 14, 1908, p. 109.
Probezzia elegantula (Johannsen) Malloch, Proc. Biol. Soc. Wash., Vol. 27, p. 137.

This species is not in the collection of this Laboratory. It was described from specimens taken at Lawrence, Kansas, in July.

3. Parabezzia inermis Coquillett

Ceratopogon inermis Coquillett, Proc. U. S. Nat. Mus., Vol., 25, 1902, p. 86.
Probezzia inermis (Coquillett) Malloch, Proc. Biol. Soc. Wash., Vol. 27, p. 137.

In coloration this species closely resembles *petiolata,* but the mesonotum is opaque and is whitish pruinose on the sides, while the scutellum is yellow.

Length, nearly 1 mm.

Described from a single female, taken at Hot Springs, Yavapai County, Arizona.

The species is not recorded for Illinois.

Addendum to Ceratopogoninæ

Since writing the part of this paper dealing with the genus *Heteromyia* I have seen a specimen of *pratti* Coquillet from Wisconsin, which has caused me to reconsider the desirability of presenting a synopsis of the species with maculate wings. It is not improbable that some of the four species occur in Illinois, and the key given below will serve to identify them.

Supplementary key to species of Heteromyia

1. Wings with 3 equidistant fasciæ.....1. *fasciata.*
— Wings with spots or with irregular black marks, not fasciate.....2
2. Thorax reddish, with 3 black vittæ; abdomen of female with shining white pruinescence; wings with 4 black spots. Small species, about 2.5 mm. in length.....2. *festiva.*
— Thorax brownish yellow or blackish, without vittæ; abdomen of female without white pruinescence; wings with 2 black spots, the outer one large and irregular in form. Larger species, 4 mm. in length 3
3. Mid and hind tibiæ with two brown rings before their tips.....3. *clavata.*
— Mid and hind tibiæ with the exception of their apices blackish brown .....4. *pratti.*

1. Heteromyia fasciata Say

Heteromyia fasciata Say, Amer. Ent., Vol. 2, p. 80. 1825.

This species is the type of the genus. It was originally described by Say without any locality being designated for it. Subsequently it was recorded for the Atlantic States by Osten Sacken, and for New Jersey by Smith.

The species which have unspotted wings have the claws of the posterior tarsi subequal, whereas those with spotted wings have, at least in the females, one claw very much longer than the other, so much so that they have sometimes been described as possessing but a single claw on the hind tarsi. Without a larger amount of material, representing both sexes of the latter group, I can not decide whether the groups should rank as distinct genera.

2. Heteromyia festiva Loew

Ceratopogon festivus Loew, Berl. Ent. Zeitschr., Vol. 5, 1861, p. 314, sp. 13.

This species was originally described from Pennsylvania by Loew, and has subsequently been recorded from New Jersey by Smith.

3. Heteromyia clavata Williston

Heteromyia clavata Williston, Biol. Cent. Amer., Dipt., Vol. 1, 1900, p. 225.

This species was originally described by Williston from Vera Cruz, Mexico, and has not been subsequently recorded as far as I am aware.

4. Heteromyia pratti Coquillett

Heteromyia pratti Coquillett, Proc. U. S. Nat. Mus., Vol. 25, 1902, p. 88.

This is the only species of the group which I have seen. The specimen was submitted by Mr. A. C. Burrill, and was taken by him at Monona Lake, Wis., July 13, 1912. The species was originally described by Coquillett from St. Elmo, Va., and has not subsequently been recorded as far as I am aware.

TANYPINÆ

Apparently no larval characters found in the described species of this subfamily can be used to separate genera, and the small amount of reared material before me does not warrant my attempting a generic synopsis of larvæ or pupæ. Few species in the Laboratory collection can be associated in larval, pupal, and imaginal stages, since in several cases of rearings either the larval or pupal exuviæ, or both, were not preserved. Very careful rearing of species, and isolation of single larvæ during the process, will be required before all of the stages of some of the species can be definitely associated.

Diamesa waltlii presents in the wing venation an approach to the *Tanypinæ*, but the larva is typical of the *Chironominæ*, and the adults show also the sexual differences present in that subfamily in which I have placed it. In no species in *Tanypinæ* that I am acquainted with have the antennæ more joints in the male than in the female, and in every species that I know in the larval stage in *Tanypinæ* the labium of the larva is of a very different structure from that of *waltlii*.

The larvæ of some of the species of *Tanypinæ* are abundant in permanent streams, pools, and lakes. Under natural conditions the larvæ are said to live in burrows in the same manner as the *Chironominæ*. Johannsen says that in captivity they seldom seem to make

tubes; but the species which I have had in this stage invariably preferred to remain under whatever debris there was in the glass, only occasionally leaving its shelter for a short time. The food is recorded as consisting of crustaceans, which have been observed active in the alimentary canal, and Johannsen states that "blood-worms are greedily devoured by *Tanypus larvæ*."* I have not seen the larvæ feed upon anything but decaying vegetable matter in the debris placed in the glasses I kept them in, though possibly that contained minute organisms, and I have not attempted to confirm Johannsen's statement regarding their eating *Chironomus* larvæ, or blood-worms.

Larval Characters

The head in larvæ of practically all the species of this subfamily is distinctly elongated, slightly narrowed anteriorly and flattened, generally presenting in lateral aspect a slightly wedge-shaped appearance. The antennæ are entirely retractile within the head; the basal joint is usually very long, greatly exceeding one-half of the entire length of the antenna (Pl. XXIV, Figs. 2, 3, 8, 13, 15). The labrum (Pl. XXV, Fig. 12) is very different in structure from that of the *Chironominæ* as there are no appendages on its under surface such as are invariably found in the members of that subfamily. The mandibles are much simpler than in *Chironominæ*, the teeth consisting of a slight and rather abrupt dilatation slightly before the middle, the apical margin of which is generally excised, forming two slight apically directed teeth (Pl. XXIV, Figs. 17, 18). The maxillary palpi are much more slender and elongated than in *Chironominæ* (see Pl. XXIV, Figs. 4, 6, 9, 10, 12). The labial plate is very characteristic in *Tanypinæ*, and is generally retracted in preserved specimens, occupying an almost vertical position or occasionally turned backward so that its anterior margin may be seen through the wall of the head. The structure of the labium and its appendages (Pl. XXV, Figs. 1–11), and the hypopharynx (Pl. XXVI, Fig. 3) are as shown in figures indicated. In young larvæ the thoracic segments are but slightly differentiated from the abdominal segments, but as the larva approaches maturity the former segments expand considerably, which, taken in conjunction with the long anal appendages and the rather tapering abdomen, gives the larva a culicid-like appearance. The anterior pseudopods are generally long and slender in *Tanypus*, though as the larva becomes more mature and the thoracic segments expand more these are gradually reduced in size and finally almost disappear.

*Aquatic Nematocerous Diptera, Bull. 86, N. Y. State Mus., p. 123. 1905.

The apices of the anterior pseudopods are armed with retractile claws. The posterior pseudopods are elongated, being in *Tanypus monilis* Linné very long and widely diverging, their apices armed with two circles of retractile claws which vary in shape and often in color (see Pl. XXVI, Figures 5, 9). The anal tufts consist of from six to about twenty long, dark, and rather stout sensory hairs, situated on more or less elongated bases. There are never any blood gills on the eleventh segment, but the twelfth has the usual two pairs on the dorsal surface, cephalad of which are always two distinct hairs. In many cases the abdomen has numerous surface hairs, though these are so fine as to be almost invisible and are easily overlooked.

Pupal Characters

Head without any frontal tubercles. Thorax much swollen, respiratory organs egg- or trumpet-shaped, never numerously filamented; wing cases distinctly separated from sides of thorax; no distinct hairs on posterior margin of thorax as in *Culicidæ*. Abdominal segments slightly flattened, without any sharp transverse ridge at center of each segment as in *Dixa;* apical segment ending in two flat appendages, which are either sharp at apex or slightly rounded, and fringed with hairs. In *Corethra* these appendages are four in number and much more conspicuous. The pupæ of *Chironomus* and some species of *Tanytarsus* may be separated from those of *Tanypinæ* by the hairlike filaments of the thoracic respiratory organs. The species of *Cricotopus* and *Orthocladius* are very similar to those of the *Tanypinæ* in the structure of the thoracic respiratory organs, but the thorax is not so conspicuously swollen, and the apical abdominal appendages generally have a few very long hairs at their tips.

Imaginal Characters

Antennæ in both sexes with 2+13 joints; the male generally with long antennal plumosity, the antennal hairs of the female confined to a whorl of much shorter hairs on each joint; frontal tubercles absent. Thorax stout, not protruding over head (Pl. XXIII, Fig. 4); pronotum distinct; sternopleura descending below level of coxæ. Abdomen stout; hypopygium much simpler than in *Chironomus,* the lateral appendages ending in a recurved process which is sometimes thornlike, and occasionally slipper-shaped; the dorsal plate (penis guard) very inconspicuous, and the superior and inferior processes indistinguishable (Pl. XXVIII, Figs. 1–12). Legs comparatively stout, fore metatarsus always considerably shorter than fore tibia; fourth tarsal joint occasionally obcordate; claws simple. Wing vena-

tion as in Figures 2, 5, 8, 11, Plate XXVII, the medio-cubital cross-vein present; surface hairs present on wings in some genera.

Key to Genera* (Imagines)

1. Wings with distinct surface hairs....2
— Wings bare....4
2. Cubitus forking slightly before the cross vein...*Tanypus* (p. 366).
— Cubitus forking distinctly beyond the cross vein....3
3. Anterior branch of radius (R_1) forked at its apex.... ....*Protenthes* (p. 381).
— Anterior branch of radius not forked....*Trichotanypus*†.
4. Fork of cubitus petiolate....5
— Cubitus forking proximad of the cross vein....6
5. Anterior branch of radius (R_1) forked at apex.... ....*Procladius* (p. 390).
— Anterior branch of radius unforked....*Psilotanypus* (p. 395).
6. Anterior branch of radius forked at apex...*Coelotanypus* (p. 396).
— Anterior branch of radius unforked....*Anatopynia*‡.

Key to Larvæ

1. Labium with 4 teeth (Pl. XXV, Fig. 1)..*Tanypus dyari* (p. 379).
— Labium with at least 5 teeth....2
2. Outer labial tooth divided, making in all 7 teeth (Pl. XXV, Fig. 6) ....*Procladius concinnus* (p. 394).
— Outer labial tooth not divided, only 5 teeth present....3
3. Anterior branch of radius (R_1) forked at its apex.... ....*Tanypus* sp. A (p. 397).
— All labial teeth rounded, or sharp at apices....4
4. Labial plate very much elongated and narrow, the teeth long and finger-like (Pl. XXV, Fig. 5)....*Tanypus* sp. B (p. 398).
— Labium not noticeably elongated, the teeth broad....5
5. Middle tooth longest....6
— Middle tooth not as long as outer tooth....7
6. Teeth of labium forming a regularly rounded convex outline (Pl. XXV, Fig. 3)....*Tanypus carneus* (p. 378).
— Second tooth distinctly shorter than central tooth (Pl. XXV, Fig. 11)....*Tanypus pilosellus?* (p. 373).
7. Lateral process of labium with its outer side fringed (Pl. XXV, Fig. 8)....*Protenthes culiciformis* (p. 385).
— Lateral process of labium bifid....8

*My present material does not permit my giving generic keys for the larval or pupal stages.

†I have not seen this genus from Illinois.

‡This genus has not been found in North America.

8. Claws of posterior pseudopods all of one color.....
.....*Tanypus decoloratus* (p. 370).
— Some of the claws of posterior pseudopods black, contrasting with the pale brown color of the others.....*Tanypus monilis* (p. 375).

Key to Pupæ*

1. Thoracic respiratory organs egg-shaped, large, black, and conspicuous 2
— Thoracic respiratory organs generally elongated, trumpet-shaped, and pale in color.....4
2. Respiratory organ ovate, without distinct apical aperture or long hairlike appendages, the surface finely honeycombed, each cell with a small black central dot (Pl. XXIV, Fig. 19).....
.....*Tanypus monilis* (p. 375).
— Respiratory organ with hairlike appendages.....3
3. Apex with a distinct aperture, no long apical hair present (Pl. XXVI, Fig. 13).....*Protenthes punctipennis* (p. 383).
— Apex without distinct aperture and with a long conspicuous hair (Pl. XXIV, Fig. 7).....*Tanypus illinoensis* (p. 376).
4. Respiratory organ ending in a slightly produced point (Pl. XXIV, Fig. 11), apical abdominal appendages obtusely rounded.....
.....*Protenthes culiciformis* (p. 385).
— Respiratory organ obtuse at apex.....5
5. Apical abdominal appendage with the inner apical angle produced 6
— Apical abdominal appendage without a distinct production of the inner apical angle.....7
6. Apical production of abdominal appendage long and conspicuous, lateral margins of appendages with 2 long lanceolate hairs.....
.....*Protenthes stellatus*† (p. 383).
— Apical production very short and inconspicuous, lateral margins of appendages without the 2 long hairs.....*Procladius pinguis.*
7. Apical abdominal appendages sharply pointed.....8
— Apical abdominal appendages obtuse at apex.....13
8. Thoracic respiratory organ club- or cornucopia-like.....9
— Thoracic respiratory organ with the greatest diameter before apex 10
9. Thoracic respiratory organs club-shaped, no transverse row of tubercles between their bases.....*Tanypus flavifrons.*
— Thoracic respiratory organs in the form of a cornucopia (Pl. XXIV, Fig. 14), a transverse row of short tubercles between their bases .....*Tanypus piloscllus?* (p. 373).

*Species without page citations are unknown to me.

†Thoracic respiratory organ of pupa evidently broken in the specimen before me.

10. Apical half of each of the abdominal appendages very slender, the breadth of each at base of that part not over one third the length of apical half.....11
— Apical half of abdominal appendage about equal in length to its breadth at base of that part.....12
11. Abdominal appendages twice as long as their combined basal breadth .....*Tanypus decoloratus* (p. 370).
— Abdominal appendages one fifth longer than their combined basal breadth.....*Tanypus carneus** (p. 378).
12. Thoracic respiratory organ about three times as long as its greatest diameter, small and inconspicuous.....*Tanypus fastuosus.*
— Thoracic respiratory organ more than three times as long as its greatest diameter, long and conspicuous.*Tanypus dyari* (p. 380).
13. Apex of respiratory organ bell-shaped (Pl. XXVII, Fig. 4); margin of abdominal appendage with over 100 short hairs..... .....*Procladius concinnus* (p. 394).
— Apex of respiratory organ not bell-shaped (Pl. XXVII, Fig. 9); abdominal appendage with few marginal hairs (Pl. XXVI, Fig. 12) .....*Protenthes bellus* (p. 388).

Tanypus Meigen

The species belonging to this genus are readily separable from those in *Procladius* by the presence of hairs on the surface of the wings, and from *Protenthes* by the sessile cubitus.

I give a key to the Illinois species in the Laboratory collection, and descriptions by means of which they may be separated from other North American species which have not yet been taken in this state. As in other genera, it is highly probable that many species occur in Illinois which are not represented in the collection before me, but from lack of examples of already described species and to avoid extending this paper on the uncertain basis of the slender clues afforded by some of the descriptions—such course being usually disastrous—I have not attempted to present a key to all the described North American species.

Key to Species

1. Wings without dark spots or bands, at most the cross vein blackened 2
— Wings with distinct dark spots or bands.....7
2. Large dark species, 4–5 mm.; thorax with brown vittæ which are rather spotlike; cross vein of wings conspicuously blackened.... .....1. *hirtipennis.*

*This distinction is based upon a comparison of a mounted specimen of *decoloratus* with Johannsen's figure of *carneus.*

— Smaller species, 2–3 mm., or if over 3 mm. then pale yellow in color 3
3. Large yellow species, 3.5–4.5 mm.; female without dark marks, the male with brown bands on the anterior half of the abdominal segments ..... 2. *melanops.*
— Smaller species, 2–3 mm. in length 4
4. Cross vein of wings infuscated; fore tarsus with basal joint four fifths as long as fore tibia ..... 3. *decoloratus**.
— Cross vein not infuscated 5
5. Male with fore tarsus bearded, the abdomen with pale spots on the sides of the segments of the basal half ..... 4. *inconspicuus.*
— Male with the fore tarsus inconspicuously haired, segments of abdomen with pale posterior margins 6
6. The pale margins to segments 2, 4, and 6 very broad ..... 5. *pilosellus.*
— All abdominal segments with pale margins of same width ..... 6. *marginellus.*
7. Tibiæ with 3 brown bands, one near base, one slightly beyond middle, and one at apex 8
— Tibiæ without any brown bands at middle 9
8. Second brown band on tibiæ very distinctly beyond middle, the subbasal yellow band distinctly broader than the subapical one ..... 7. *monilis.*
— Second brown band on tibiæ near the middle, the 2 whitish bands subequal in width, or the subbasal one the narrower ..... 8. *illinoensis.*
9. Wings with distinct spots, not banded ..... 9. *venustus.*
— Wings with distinct fasciæ 10
10. Legs uniform yellow, only a short black comb at apices of tibiæ ..... 10. *carneus.*
— Legs with at least brown preapical band on the femora 11
11. Numerous clear rounded spots in the preapical fascia of the wing; apices of femora and bases of tibiæ with brown bands ..... 11. *dyari.*
— Preapical fascia irregular, but without any clear rounded spots; only the femora with a brown band ..... 12. *johnsoni.*

1. Tanypus hirtipennis Loew

Tanypus hirtipennis Loew, Berl. Ent. Zeitschr., 1866, p. 5.

Male.—Brownish black. Head yellowish; antennæ and antennal plumes brown, the second joint almost black; palpi brown. Mesonotum densely gray pollinose, a small subtriangular area behind humeri blacker than the rest of disc, each side of the divided central

**Fastuosus* Johannsen is evidently very closely related to this species, but the length of the fore metatarsus is given as .6 the length of the fore tibia. The cross vein is said to be "especially distinct," which separates it from *pilosellus* and *inconspicuus.*

stripe with a short brown streak on its posterior third, at middle of disc; pleuræ yellowish on central upper half, on other portions as disc of menosotum; scutellum and postnotum as disc of mesonotum. Abdomen with the apical half of each segment yellowish, covered with whitish dust, the black portion produced posteriorly in the form of a short point at center. Legs obscurely yellow, apices of all femora broadly and of tibiæ and tarsal joints narrowly brown. Wings slightly grayish; veins yellow; cross vein very distinctly blackened. Halteres whitish.

Antenna as long as from cross vein to apex of wing, the fifteenth joint nearly twice as long as the rest of the flagellum, second joint very large; frontal tubercles absent. Mesonotum with brownish yellow hairs on the spaces between the vittæ; a conspicuous group of hairs in front of the wing-base; a group of hairs on pleura above and between fore and mid coxæ (sternopleura); scutellar hairs numerous and rather long. Apical portion of lateral arm of hypopygium whitish, slender, and thornlike (Pl. XXVIII, Fig. 2). Legs long, short-haired, basal joint of fore tarsus almost as long as the remaining joints together; fourth tarsal joint of all legs longer than fifth. Costa reaching almost to apex of wing, cross vein at middle; cubitus forking distinctly before cross vein; surface hairs distinct but not very numerous, pale in color.

Length, 5 mm.

Female.—Similar in coloration to the male.

The antenna has the basal joint smaller than in the male, and the hairs are only of moderate length; palpi with the basal joint slightly thickened, second joint thicker than first and subequal in length, third joint almost as long as first and second together and slender, apical joint slender, subequal in length to second. Thorax haired as in male though the hairs are rather more conspicuous. Abdomen with the surface covered with rather long pale hairs. Legs rather stouter than in male, proportions of tarsi similar to those of the male. Wing surface very densely covered with brownish yellow hairs; cross vein very distinctly blackened; costa reaching almost to wing-tip, curved well round the margin; cross vein very slightly before middle.

Length, 4.5 mm.

Illinois localities: Urbana, May 20, 1906, one male and one female; Muncie, Dubois, Grand Tower, and Golconda, April and May, 1914. Specimens taken by C. A. Hart and the writer.

The female of this species was originally described from Maine by Loew, and as far as I am aware has hitherto been recorded but twice since—by Fyles, from Quebec, Canada, and by Johannsen. This is

the first description of the male, and a description of both sexes is here given to facilitate the recognition of the species. The early stages are not known.

2. Tanypus melanops Meigen

Tanypus melanops Meigen, Syst. Beschr., Vol. I, 1818, p. 65; 18.

Male.—Pale yellow. Eyes black. Thoracic vittæ very pale reddish yellow. Abdomen with generally a narrow brownish fascia on each abdominal segment, except the first, near to base. Legs pale yellow, mid and hind tibiæ with a short black apical comb. Wings clear, all veins pale yellow. Halteres whitish. All hairs pale yellow.

Antenna slightly longer than head and thorax together, second joint large, globose. Thoracic hairs soft and rather long. Hairs of abdomen long and numerous; hypopygium as in Figure 3, Plate XXVIII. Fore tarsus with long hairs, basal joint three fourths as long as fore tibia. Mid and hind legs long-haired. Cross vein slightly before wing-middle; costa ending shortly before curve at apex of wing.

Female.—Differs in color from the male in the absence of the abdominal bands.

The antennæ are distinctly shorter than the thorax, and have rather longer hairs than most females in this genus. The fore tarsus has the basal joint slightly less than three fourths as long as the fore tibia, and is without the long hairs; the other legs are shorter-haired than in the male. The wings are rather broad, and the cross vein is nearer to base of wing and the costa reaches nearer to curve of wing than in the male.

Length, 4–5 mm.

Illinois localities: St. Joseph, Monticello, Urbana, Easton, Havana, and Muncie, April 28 to October 2. Common, occasionally at light.

A specimen from Muncie agrees in color with the female. The probability is that *nigropunctatus* Staeger is synonymous with *melanops*, as practically the only distinction between the two lies in the presence of abdominal fasciæ in the former and their absence in the latter.

Johannsen records *melanops* from New York, Michigan, Nebraska, and New Jersey. I have seen specimens from Lafayette, Ind. (Aldrich), and Racine, Wis. (C. R. Cleveland).

3. Tanypus decoloratus, n. sp.

Larva.—Length, 5 mm. Almost entirely white, only the labial plate, apices of mandibles, and claws of the posterior pseudopods brown. Head about twice as long as its greatest breadth; sides slightly convergent on apical half; antennæ slightly more than half as long as head, the apical portion about one fifth as long as the basal; basal portion of the maxillary palpus slender, subequal in length to the apical portion of antenna, the apical processes short, barely longer than the diameter of the basal portion; mandible as in Figure 1, Plate XXVI; labial plate similar to that of *monilis* (Pl. XXV, Fig. 10). In other respects similar to the larva described as *pilosellus* (?).

Pupa.—Length, 4 mm. Yellow, the thorax and the anterior half of each abdominal segment shaded with brown. Thoracic respiratory organ as in Figure 6, Plate XXVII; laterad of respiratory organs, a short transverse row of about twelve minute thorns. Abdominal segments, except the last two, without lateral hairs; seventh segment with four lanceolate hairs on each side; eighth segment with similar hairs on almost the entire length of lateral margins, a longitudinal row of microscopic hairs midway between the median line and the lateral margin, and a group of stronger hairs at the anterior lateral angle; apical processes similar to those of *pilosellus* (?).

Imago; Male.—Pale buff. Antennæ and their plumes brownish yellow. Thoracic vittæ pale reddish brown, postnotum slightly darkened on dorsum. Basal half of each abdominal segment brownish on dorsum. Legs pale yellow. Wings clear, the cross vein brown, other veins yellow. All hairs on body and legs yellow. Halteres whitish.

Antenna distinctly longer than head and thorax together, second joint yellow and much swollen. Mesonotum with long soft hairs on the spaces between vittæ and several shorter hairs in front of wing-base. Abdomen slender; segments with rather long hairs; apical lateral recurved process of hypopygium slender, nearly as long as basal portion, its shape very much as in hypopygium of *Tanypus monilis* (Pl. XXVIII, Fig. 1). Legs slender, mid and hind pairs, with the exception of the last three tarsal joints, long-haired; fore tibia about one fifth longer than basal joint of fore tarsus; all tarsi with the fifth joint much shorter than the fourth. Cross vein very slightly before the middle of wing; costa extending to curve at apex of wing; media reaching margin a little behind tip of wing, slightly deflected near apex; cubitus forks slightly before cross vein; surface of wings with regularly distributed short hairs.

Female.—Reddish yellow. Mesonotum with faint indications of vittæ. Legs entirely yellow, the comb at apices of mid and hind tibiæ weak. Wings clear, veins pale yellow.

Antenna shorter than length of thorax, and distinctly shorter than wing from base to cross vein; basal joint not much swollen, apical joint very slightly so; hairs on antenna long. Mesonotum, pleuræ, and scutellum haired as in the male, the abdominal hairs rather long. Legs slender; basal joint of fore tarsus as long as the next three joints and two thirds as long as fore tibia; fourth tarsal joint of all legs longer than fifth; surface hairs not conspicuous, longest at apices of hind tibiæ, where their length is about twice the diameter of the tibia. Wing almost as in *pilosellus,* but the costa extends distinctly round the curve at apex.

Length: male, 3 mm.; female, 2 mm.

Type locality, Thompson's Lake, Havana, Ill., May 1, 1914. A single male reared from a larva taken by dredging in water eight feet deep. A male was taken at Muncie, Ill., May 24, 1914, on the bank of Stony Creek. The female described above I consider as belonging to this species, though it is especially difficult to identify the females of this group owing to their differing so much from the males in color and venation. Locality of female, Havana, Ill., September 12, 1895, at light.

4. Tanypus inconspicuus, n. sp.

Male.—Fuscous. Basal joint of antennæ dark brown, remaining parts of head pale fuscous. Thorax with whitish pruinescence on spaces between the vittæ and on sutures of pleuræ; prescutum yellowish; vittæ dark brown; scutellum yellowish, centrally fuscous; postnotum with whitish pruinescence, and generally a central narrow streak and a spot on each side of it brown. Abdomen with the anterior half of each dorsal segment distinctly whitish pruinose, the segments on the basal half of abdomen with a yellow spot on each side of the posterior half, leaving the dark color in the form of a dorsal stripe with anterior lateral extensions on each segment; hypopygium reddish brown. Legs brownish yellow, each femur with a brown band-like mark at apex. Wings slightly fuscous, the veins at extreme base and the cross vein posterior to humeral vein blackish, the cross vein near wing-middle not blackened. Halteres yellow. Hairs yellowish brown.

Antenna slightly longer than head and thorax together, basal joint globose, large. Mesonotum with the discal hairs confined to the spaces between the vittæ and to the lateral margins; hairs on scutellum long.

Abdomen with hairs of moderate length on the entire surface; hypopygium similar to that of *Tanypus dyari* (Pl. XXVII, Fig. 12), except that it is stouter, the apical portion tapering more abruptly, and the black thornlike apical process of that portion being about a fifth the length of the pale part. Legs slender, fore tarsus long-haired, basal joint about three fourths as long as fore tibia; mid and hind legs and apices of fore tibiæ with long hairs. Distance from humeral vein to cross vein less than half the distance from cross vein to wing-tip; third vein not extending to curve of wing.

Female.—Slightly paler than the male; the antennæ entirely yellow; thorax almost the same as in the male; abdomen brownish, the posterior margins yellowish; legs and wings as in the male.

Antennæ about equal in length to thorax, basal joint less swollen than in the male, apical joint elongated, hairs rather long but sparse. Thorax as in the male. Abdomen stout; surface hairs moderately long. Legs less distinctly hairy than in the male, especially the fore tarsi; basal joint of fore tarsus over two thirds as long as fore tibia. Distance from cross vein to apex of wing two and a half times as great as distance from cross vein to humeral vein.

Length: male, 3–3.5 mm.; female, 2.5–3 mm.

Type locality, Easton, Ill., May 1, 1914. Several specimens of both sexes taken at the Central Ditch, over one mile from Easton.

Early stages unknown.

5. Tanypus pilosellus Loew

Tanypus pilosellus Loew, Berl. Ent. Zeitschr., 1866, p. 5.

Male.—Yellowish to grayish. Head, antennæ, antennal plumes, and palpi yellow; basal joint of antennæ brown. Thorax generally grayish, or brownish yellow with gray pollinosity, stripes sometimes indistinct; scutellum yellow, generally brownish at center; postnotum dark brown. Abdomen gray or blackish, apices of all except the last segment yellowish white, the second, fourth, and sixth most conspicuously so; apical portion of lateral arm of hypopygium whitish. Legs yellow or whitish, apices of mid and hind tibiæ with a short black comb. Wings clear, veins yellow. Halteres yellow, knob brownish.

Antenna much shorter than wing from cross vein to apex; the last joint not one and a half times as long as the preceding flagellar joints together. Hairs on mesonotum very long, regularly arranged along the whole length of the spaces between the vittæ; no conspicuous group in front of wing-base, and no discernible sternopleural hairs; scutellar hairs very long and numerous. Abdomen slender, the sur-

face hairs very long and assuming a whorl-like arrangement on each segment; apical portion of lateral arm of hypopygium shaped somewhat like that of *illinoensis*, but the thicker, or main branch of the stem is not clubbed at apex. Legs slender; basal joint of fore tarsus shorter than the next two joints together and about three fifths as long as fore tibia; mid and hind legs with long surface hairs; fore tarsus with short hairs; fourth tarsal joint longer than fifth. Wings rather narrow, cross vein well before middle; costa reaching to curve at apex of wing; surface hairs numerous and distinct.

Female.—Similar in coloration to the male except that the abdomen is generally almost entirely yellowish, or occasionally with the dorsum grayish.

The antennæ are very slightly longer than the thorax, and as long as from base of wing to cross vein; the hairs are rather long and fine, and the apical joint is not swollen. The body is stout and has short surface hairs. In other respects as the male.

Length, 1–1.5 mm.

Illinois localities: Havana, at light, September 12–15, 1895; same locality, June 15, September 16 and 27; Quiver Lake, Havana, July 27, 1896; Ashley, Havana, Carmi, Grand Tower, and Golconda during the latter part of April, 1914; Monticello, June 28; Momence, July 17; Urbana, October 5—the last two at light (C. A. Hart and J. R. Malloch).

Originally described from the District of Columbia. I have seen a specimen from Lafayette, Ind. (Aldrich).

Coquillett described *pallens* from Las Vegas Hot Springs, N. M., and without comparing the specimens in hand with his type of that species it is impossible to decide whether our specimens are *pallens*. The markings on the abdomen vary considerably in the series of specimens before me, and may occasionally appear as described by Coquillett.

The descriptions that follow probably apply to the larva and pupa of *pilosellus*, but as they have not been reared the identification is only provisional.

Larva.—Length, 3 mm. Head two and a half times as long as its greatest breadth, slightly tapering anteriorly, ventral surface as shown in Figure 14, Plate XXVI; a single large black eye-spot on each side at middle; antennæ retracted but the basal portion apparently not over twice as long as the apical portion, the whole about half as long as the head; mandible pale, apical tooth sharp, but not very slender, a truncated tooth near middle of inner surface; labial plate toothed as in Figure 11, Plate XXV. Anterior pair of pseudopods very long and

slender, fused nearly to their apices; body tapering posteriorly, the segments very distinct, no distinguishable hairs present; posterior pseudopods much elongated, divergent, their apices armed with two circles of long, slender, pale claws, the preapical row rather stouter than the apical one; dorsal respiratory organs long and slender, rather pointed, the two hairs just above their bases distinct; anal tuft with six sensory hairs, the basal papilla long and slender, about five times as long as thick.

Pupa.—Length, 2.25 mm. Thoracic respiratory organ large, in the form of a cornucopia (Pl. XXIV, Fig. 14); a transverse row of small pointed tubercles between the respiratory organs; apical abdominal appendages as in Figure 8, Plate XXVI.

The larva described, was taken from the Illinois River, with a Birge net, August 27, 1894; and the two pupæ were taken amongst vegetation at the same place (Havana) and by the same method, August 25, 1894.

6. Tanypus marginellus, n. sp.

Male.—Yellowish or greenish, slightly shining. Scape of antennæ blackish, flagellum obscurely greenish. Mesonotum with three black vittæ, the middle vitta divided by a narrow yellowish line, the spaces between vittæ with gray pruinescence; pleuræ blackish gray with the exception of the membranous portions, which are yellowish or greenish; scutellum yellow darkened at base; postnotum shining black. Abdomen shining; basal two-thirds of each segment black; hypopygium yellowish. Legs yellow, without distinct dark marks. Wings clear, veins yellow, cross vein not infuscated. Halteres yellow. Hairs on body and legs yellow, plumes of antennæ brown.

Antenna distinctly longer than head and thorax together. Pronotum distinct to upper margin. Thoracic hairs rather weak. Abdomen slender, surface hairs regularly distributed; hypopygium as in Figure 10, Plate XXVII. Legs slender, femora and tibiæ of mid and hind pairs rather long-haired; fore tarsi pubescent, basal joint slightly less than two thirds as long as tibia. Third vein not extending to apex of wing; cross vein a little more than one third of the distance from humeral vein to wing-tip.

Female.—Similar to male except that the abdomen is almost unicolorous yellow, the antennæ are shorter than the head and thorax and short-haired, and the cell enclosed by the third vein disappears before apex of costa.

Length: male, 2.5 mm.; female, 2 mm.

Type locality, Dubois, Ill., April 24, 1914; swept from vegetation in creek valley (C. A. Hart and J. R. Malloch).

A male taken at Palo Alto, California, May 1, 1906, submitted by Professor Aldrich, may belong to this species, but its condition is too poor to permit a definite opinion.

This is in all probability the same species as that identified by Professor Johannsen as *T. indecisus* Williston. The latter was described from St. Vincent, West Indies, and apart from the unlikelihood of its occurring so far north as New York and Illinois there are sufficient differences between the two descriptions to warrant their separation as distinct species.

7. Tanypus monilis Linné

Tipula monilis Linné, Syst. Nat. X, 1758, p. 587.

Larva.—(Pl. XXIV, Fig. 1). Length, 6 mm. Brownish or yellowish in color. Head brownish yellow, nearly twice as long as wide; antennæ very long and slender (Pl. XXIV, Fig. 2); maxillary palpi as in Figure 10; mandibles with apical half slender, towards the extremity distinctly blackened; labium with five teeth, its apex conspicuously blackened (Pl. XXV, Fig. 7); lateral labial process with two branches. Anterior pseudopods with curved claws; no hairs on abdominal segments; anal pseudopods slender and very much elongated, their apices armed with curved claws arranged in two circles, and consisting of numerous slender pale claws with several shorter and stouter black ones. Dorsal sensory tufts consisting of six hairs, situated upon bases which are about six times as long as their own diameter; four dorsal respiratory organs present and above them two weak hairs.

Pupa.—Length, 4.5 mm. Dark yellowish or, when nearing maturity, brownish. Thoracic respiratory organs black or brownish, shape as in Figure 19, Plate XXIV. A transverse row of short thornlike tubercles near base of respiratory organ. Apical appendages of abdomen sharply pointed, and with very few marginal hairs.

Imago; Male and Female.—Yellowish brown to dark brown. Head yellowish or brownish; antennæ yellow, basal joint brown, the plumes brown; palpi yellow. Mesonotum generally distinctly vittate and grayish pollinose on the spaces between the vittæ; scutellum yellow; postnotum brown on disc. Abdomen generally translucent yellow with the bases of the segments more or less suffused with brown and the apical segments entirely brownish. Legs whitish yellow, with brown rings as follows: near apex of femora, near base of tibiæ, beyond middle and at apex of same, before middle and at apex of

each basal joint of tarsus, and at apex of the other tarsal joints. Wings as in Figure 11, Plate XXVII. Halteres yellow.

Male.—Antenna slightly longer than head and thorax taken together, apical joint twice as long as remaining flagellar joints together, basal joint much swollen; third palpal joint barely longer than the slender second joint. Mesonotum with long hairs on spaces between the vittæ; no conspicuous group of hairs before wing-base, and none discernible on sternopleura. Hypopygium as in Figure 11, Plate XXVIII. Legs long and slender; basal joint of fore tarsus two thirds as long as fore tibia, and distinctly shorter than the next two joints together; mid and hind legs with long hairs, those on the tibiæ equal in length to about four times the tibial diameter, fourth tarsal joint of all legs very much longer than fifth.

Female.—Similar in color to the male, though generally slightly darker, especially in the wing-markings.

Length, 4.5–5 mm.

This species has been taken in the larval and pupal stages in considerable numbers in the Illinois River and associated waters in connection with the work of this Laboratory on the biology of that river, the following localities being represented: Copperas Creek, Thompson's Lake, Havana, Round Prairie (near Havana), Matanzas Lake, Beardstown, Fish Lake, Meredosia, Naples, La Grange, Hardin, and Grafton. Imagines have been taken at Algonquin, June 24, 1895 (W. A. Nason); at Urbana, in May and July; and at Havana, in April, May, and September, some being taken at light, and two reared from larvæ found in a rain-water barrel. Probably the species occurs throughout the entire summer and fall.

Johannsen records *monilis* from New Jersey, Illinois, New York, and South Dakota. I have seen specimens from Plummer's Island, Md., and Washington, D. C. (W. L. McAtee).

8. Tanypus illinoensis, n. sp.

This species resembles *monilis* so closely that it will be sufficient to indicate little more than the points of difference between them.

Larva unidentified.

Pupa.—(Pl. XXIV, Fig. 7). Length, 6 mm. Color as in *monilis*. The thoracic respiratory organs are similar to those of *monilis*, differing as stated in key. In *monilis* there is a transverse row of 3–4 short tubercles between the respiratory organs. It is impossible from the dissections before me to say whether the two rows of short tubercles, 8–10 in each row, lay transversely between the respiratory

organs or laterad of them. The number of the tubercles is, however, sufficient to indicate a specific difference. The anal appendages of the abdomen are as in *monilis*.

Imago; Male and Female.—Differ in color from *monilis* in being generally paler, the light-colored parts being almost white and, as a rule, the wings presenting a rather milky appearance. The difference in the annulation of the legs I have indicated in the key. The basal joint of the fore tarsus is slightly longer than the next two joints together, whereas in *monilis* it is slightly but distinctly shorter. The apical portion of the lateral arm of the hypopygium is as shown in Figure 10, Plate XXVIII, the subapical process ending in an acute point. The wing venation and markings are almost identical in the two species, the principal difference lying in the spots on the apical half of the costa. In *monilis* there are generally three distinct spots, as shown in Figure 11, Plate XXVII, while in *illinoensis* the first two are fused or the second and third are indistinct.

Length, 3.5–4.5 mm.

Type locality: Junction of Illinois and Spoon rivers at Havana—numerous examples, with various dates of capture extending from May to end of September. Paratypes from Carbondale, Ill., April 27, 1908, one specimen, and Algonquin, May 13, 1896 (W. A. Nason). The only pupa which I have seen was taken in the Illinois River near the shore at Havana in 1913. Besides the Illinois examples I have seen imagines from Lake Delavan, Wisconsin, taken in September, 1892, which are in the State Laboratory collection, and several belonging to the collection of the United States Bureau of Biological Survey, taken at Plummer's Island, Md., and Washington, D. C., in June and August—October. The probability is that the species is widely distributed, and the dates given above indicate that it occurs throughout the entire summer and well into the fall.

9. Tanypus venustus Coquillett

Tanypus venustus Coquillett, Proc. U. S. Nat. Mus., Vol. 25, 1902, p. 91.

Male.—Brown-black. Head brownish yellow; antennæ and antennal plumes brown, flagellum slightly paler; palpi yellow. Mesonotum opaque and silvery pollinose, vittæ rather indistinct, the pollinosity irregularly distributed, forming in places spotlike markings; pleuræ yellowish above, brown on lower portions, slightly shining; scutellum yellow. Abdomen with apical third of each segment whitish yellow; hypopygium yellow. Legs yellow, a distinct preapical band on femora, and a broad band near bases and a narrow one at

apices of all tibiæ deep brown. Wing with about twelve spots formed by brown hairs: three or four between the media and radius, two between upper branch of cubitus and media, two between branches of cubitus, and three between the posterior margin and cubitus.

Structurally this species is very similar to *illinoensis*, but it is rather more slender and the wing is narrower. I have only a single specimen before me, and having refrained from detaching the hypopygium it is of course impossible to discover in what respects that differs from the hypopygium of *illinoensis*. As the tarsi of the fore legs are broken off I am unable to compare their proportions with those of the tarsi of *illinoensis*. The different coloration of the two species should serve to separate them readily. The mid and hind tibiæ have surface hairs which are at least three times as long as the diameter of the tibiæ.

Length, 3 mm.

Illinois localities: Algonquin, June 6, 1895 (W. A. Nason); Urbana, July 7, 1914, at light (J. R. Malloch).

Originally described by Coquillett from Las Vegas Hot Springs, New Mexico, and subsequently recorded by Johannsen from Leland Stanford Jr. University, California.

10. Tanypus carneus Fabricius

Tanypus carneus Fabricius, Syst. Antl., 1805, p. 41; sp. 16.

Larva.—I have seen only a single larva of this species from the Illinois River. It resembles *monilis* very closely and is of the same length (6 mm.), but may be separated by means of the following characters:—

Reddish yellow in life, almost white when preserved in alcohol. Head very long, almost three times as long as wide; antenna with the basal joint about three fourths the entire length; labial plate as shown in Figure 3, Plate XXV; posterior pseudopods with rather slender claws, all of them pale brownish.

Pupa.—"Yellowish; length, 4 mm. Respiratory trumpet cucumber shaped, with basal end somewhat curved and tapering; near the base of each is an arcuate transverse line of pale, blunt tubercles. Abdominal segments nearly devoid of setae. The caudal fin consists of two pointed processes, each with a pair of pale, slender filaments, and on the lateral margin of each of the last 2 segments are four or five of such filaments."—*Johannsen.*

Imago; Male.—Head pale yellow, including basal joint of antenna. Thorax pale yellow, with three wide buff stripes, or it may be

said that the dorsum of the thorax is buff, having three fine whitish lines, upon which there is a row of closely set pale hairs. In some lights the anterior part of the thorax, a space in front of the scutellum, and the scutellum have a whitish sheen. Pleuræ with three brownish bars or spots. Abdomen pale yellow; near the anterior margin of each segment is a transverse row of brown spots, which are sometimes confluent and form bands. Legs, including coxæ, cream-white, the hairs pale, apex of each tibia with a very minute black comb with one tooth prolonged into a spur. Fore metatarsus more than three fourths as long as its tibia. Wings with a brown cloud covering the cross veins, a larger, paler cloud at the tip of R_1 extending nearly across the wing, but very faint beyond the media; a third faint cloud at apex of posteria branch of cubitus, extending to media; a fourth very faint one in the anal cell. Halteres white.

Female.—Differs from the male in having pale yellow antennæ; palpi sometimes pale; abdomen yellow, the posterior margin of the segments with a whitish sheen. (Abridged from Johannsen's description.)

Length, 3.5–4 mm.

This European species has been recorded from New York by Johannsen, and a single larva taken from the Illinois River at Grafton in 1913 agrees with the description of the larvæ from which Johannsen reared his specimens. I have seen one male specimen belonging to the collection of the Academy of Natural Sciences, Philadelphia, taken at Westmont, N. J., April 5, 1901.

11. Tanypus dyari Coquillett

Tanypus dyari Coquillett, Ent. News, Vol. 13, 1902, p. 85.

Larva.—Length, 8–9 mm. Blood-red. Head about one and a third times as long as broad; antenna less than half as long as head (Pl. XXVI, Fig. 11); palpi half as long as mandibles; mandible strong, apical tooth blackened, the teeth along the inner dorso-lateral edge distinct (Pl. XXIV, Fig. 18); hypopharynx (Pl. XXVI, Fig. 3) brown, showing as distinctly as that of *Protenthes culiciformis;* labium with 4 teeth (Pl. XXV, Fig. 1), the lateral process with long fringe. Anterior pseudopods without strong apical claws; abdominal segments with numerous long, pale hairs laterally; posterior pseudopods with the two circles of claws pale brown, one circle much stronger and shorter than the other (Pl. XXVI, Fig. 5, shows one of the strong claws); papillæ of the dorsal tufts about four times as long as their diameter; dorsal tuft consisting of twelve sensory hairs; a dis-

tinct pair of hairs near apices of papillæ and another near the middle; a pair of long hairs above bases of dorsal blood-gills and another on the inner dorsal surface of each of the pseudopods near their bases.

Pupa.—Length, 6–7 mm. Yellowish to fuscous. Thoracic respiratory organs rather long and conspicuous, their apical opening large, surfaces with short setulæ (Pl. XXIV, Fig. 16); no noticeable tubercles near bases of respiratory organs. Apical abdominal appendage produced into a fine point at tip, the lateral margin ciliated.

Imago; Male and Female.—Pale ochreous yellow to reddish yellow, opaque. Mesonotum with the vittæ generally indistinct, the whole disc white pollinose, most distinctly so on the vittæ when viewed from behind; thoracic hairs long and pale except on the posterior third of the spaces between the stripes, where they are very long and dark brown; scutellum yellow; postnotum yellow, with a brown tinge. Abdomen yellow, basal half of each segment brownish, the dark color usually carried backward at center on each segment; surface hairs long and pale except a patch on each side of the median line at posterior extremity of each segment in female, where they are dark brown. Legs yellow; a brown band near the apices of the femora and near to bases of the tibiæ; mid and hind tibiæ with a short black comb at apices. Wings with two brown bands, one over the center of wing and the other on apical third, the latter much interrupted before apex and with a number of rounded clear spots in the dark part. Halteres yellow.

Antenna of male very similar to that of *monilis*, the plumes yellowish. Mesonotum with very long hairs which cover almost the entire disc and are most conspicuous on posterior third of the spaces between the vittæ and in front of wing-base, where they are brown; a group of hairs present on sternopleura above; scutellar hairs long. Hypopygium as in Figure 12, Plate XXVII. Basal joint of fore tarsus about two thirds as long as fore tibia and distinctly longer than the next two joints together; hairs on fore tarsus at least twice as long as diameter of tarsal joints; mid and hind legs, especially the tibiæ, long-haired; fourth tarsal joint on all legs longer than fifth.

Antenna of female slightly shorter than thorax, surface hairs of moderate length, last joint slightly swollen. In other respects much the same as the male, except that the abdomen is shorter and stouter and the wings are comparatively broader, as is always the case in this genus. The legs are similar in proportions to those of the male, but the hairs are considerably shorter.

Length, 4.5 mm.

Illinois localities: Illinois River at Morris, from above the dam at Marseilles (pupæ); creek at Urbana (pupæ); Algonquin, July 21,

1896 (W. A. Nason); and Urbana (imagines). Seven specimens were reared from a lot of larvæ found in the creek at Urbana, but only pupæ were preserved, the larval exuviæ not being found in the vial. Two of the imagines were captured in June and July; the others were taken at light October 2 and 9, in a house in late October (22), amongst evergreens November 2, and one, December 2, marked "hibernating." The species may hibernate in the imago stage, though larvæ are found as early as March (Miss Mitchell).

This species has been recorded by Johannsen from the following states: New York, Massachusetts, South Dakota, Pennsylvania, and Michigan, and also from the District of Columbia. I have seen specimens, submitted by Professor Aldrich, from Moscow and Potlach, Idaho, and from Palouse, Wash., the months of capture being April and September.

12. Tanypus johnsoni Coquillett

Tanypus johnsoni, Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 609.

Male.—Differs from *dyari* in being paler in color, the thoracic vittæ being generally reddish and the ground color much paler. Abdominal segments 2–6 with basal brown band, 7 entirely brown, 8 and the hypopygium pale yellow. Legs yellow, femora with preapical brown band. Wing with two poorly defined fasciæ, one over the cross vein and the other between that and wing-tip, the latter without distinguishable clear spots in it.

The fore tarsi in this species have distinct long hairs on the posterior surfaces from before apex of basal joint to apex of fourth. Hypopygium almost identical with that of *hirtipennis* (Pl. XXVIII, Fig. 2); the hairs on abdomen unicolorous pale brown.

Female.—Agrees in coloration with the male.

Length, 3.5 mm.

Illinois localities: Momence, three males taken at light, July 17, 1914 (C. A. Hart); Algonquin, one female, May 3, 1894 (W. A. Nason).

Originally described from New Jersey, by Coquillett.

The early stages are undescribed.

Protenthes Johannsen

There are six species occurring in Illinois which are referable to this genus. Three of these, *chorcus* Meigen, *punctipennis* Meigen, and *culiciformis* Linné, were described from Europe, and while common in various parts of that continent only the latter seems to be common in Illinois. The larvæ of *culiciformis* were taken commonly

in the Salt Fork at Homer, Ill., March 21, 1914, and successfully reared in vials. This species is not described by Johannsen in the immature stages, but it seems necessary to indicate that the figures given by him for *Procladius adumbratus* (1–5 of Plate XX of his work previously cited) are in practically all particulars identical with those given herewith and drawn from cast larval skins of *culiciformis*. It is probable that the two species are very similar in the larval stage, though the only species of *Procladius* which I have reared has a very differently constructed larva. *Bellus* has occasioned me considerable trouble, and has been located here because of its general habitus rather than its possession of the surface hairs of the wing, which are remarkably weak, and in some cases, where the specimen may have been in alcohol or in some way become wet, are practically indistinguishable. This applies also to *riparius*.

Key to Species

1. Wings with distinct blackish spots in addition to the spot on the cross vein 2
— Wings without any spots except the spot on cross vein, or with indistinct clouding 3
2. Spots on wings almost black, a very distinct spot over the cross vein and extending well into first posterior and median cells; almost black species with the thorax white pollinose between the vittæ; the pale and dark color of legs sharply contrasted.... 1. *stellatus*.
— Spots on wings grayish, the spot over the cross vein not extending distinctly into first posterior cell; yellowish species with brown thoracic vittæ; leg colors not sharply contrasted. 2. *punctipennis*.
3. Wings with apical half and anterior margin of basal half grayish, the cross vein blackened, a clear patch before and beyond the cross vein ..... 3. *culiciformis*.
— Wings with only the cross vein blackened..... 4
4. Basal joint of fore tarsus over two thirds as long as fore tibia..... ..... 4. *choreus*.
— Basal joint of fore tarsus slightly more than half as long as fore tibia 5
5. Dark species, thorax, abdomen, and legs of male almost entirely black; hypopygium similar to that of *culiciformis*..... ..... 5. *claripennis*.
— Pale species, thorax, abdomen, and legs almost entirely yellow; hypopygium as in Figures 12, 7, Plate XXVIII..... 6
6. Thorax pale reddish yellow, the vittæ reddish or brown..... ..... 6. *bellus**.
— Thorax pale lemon-yellow, the vittæ black or dark gray..... ..... 7. *riparius*.

*I have placed this species in *Protenthes* because in some cases there are weak hairs discernible on the wings, and the fourth tarsal joint is elongate—not obcordate.

1. Protenthes stellatus Coquillett

— *Tanypus stellatus* Coquillett, Proc. U. S. Nat. Mus., Vol. 25, 1902, p. 89.

Pupa.—Thoracic respiratory organ broken. No discernible transverse tubercles on disc. Apical abdominal appendages shaped as in Figure 5, Plate XXIV, lateral margin of each with two long flat hairs.

Imago; Male.—Similar to *punctipennis,* but differing as follows: general color much darker, the palest parts brown; spaces between the vittæ white pollinose; apices of abdominal segments narrowly white pollinose; legs marked as in *punctipennis* but the light and dark portions more sharply contrasting; wings spotted in much the same manner as in *punctipennis,* but the spots are very dark, almost black, the most conspicuous being a large one covering the cross vein and extending well into the first posterior cell as well as into the median cell. In other respects the species appear to be very much alike. Hypopygium as in Figure 1, Plate XXVII.

Female.—Similar in coloration to the male.

Length, 2.5 mm.

Illinois localities: Thompson's Lake, Havana, September 1, 1910, Urbana and Momence, July, 1914, at light (all imagines); Matanzas Lake, Havana, August 24, 1894 (pupa).

Originally described from Texas, Kansas, and New York, and recorded subsequently by Johannsen from Ithaca, N. Y. I have seen specimens taken by Mr. Hart at Cedar Lake, Ind., July, 1914.

2. Protenthes punctipennis Meigen

Tanypus punctipennis Meigen, Syst. Beschr., Vol. 1, 1818, p. 61; 9.

Pupa.—Length, 5 mm. Very similar to pupa of *Tanypus monilis,* differing principally in the structure of the thoracic respiratory organ (Pl. XXVI, Fig. 13) and in the shape of the apical appendages of the abdomen (Pl. XXVI, Fig. 4).

Imago; Male and Female.—Yellow with a slight greenish or sometimes a brownish tinge. Head brownish, antennæ and palpi yellow, basal joint of the former sometimes brownish. Mesonotum opaque, the three vittæ pale brown, the whole surface gray pollinose; scutellum yellow; pleuræ yellow, with a brown spot below wing-base and a large triangular spot of same color between fore and mid coxæ; postnotum brown. Abdomen varying from yellow to brown, the anterior margins of segments generally darker. Legs yellow, femora generally with a brown preapical band, but sometimes in female with almost the entire femur brownish and a yellow ring at about apical fourth; tibiæ

sometimes with a pale brown subbasal band, the apices narrowly brown in all cases, as are also the apices of the tarsal joints. Wings spotted almost as in *stellatus*, the 3–4 spots in the first posterior cell most distinct, cross vein blackened (Pl. XXVII, Fig. 2).

Male.—Antenna longer than head and thorax together, structurally almost identical with that of *monilis;* plumes pale brown and very long. Thorax with very inconspicuous pale hairs, pleuræ bare. Abdomen slender; hypopygium as in Figure 3, Plate XXVII. Legs long and slender; basal joint of fore tarsus almost as long as fore tibia, and as long as next three joints together; second joint slightly longer than third; fore tarsus from near middle of basal joint to apex of fourth with long hairs which exceed in length three times the diameter of the tarsal joints upon which they are situated; hairs on mid and hind legs distinct, but not as long as those on fore tarsus. Wing narrow; cross vein near to middle; costal vein extending well round the curve at apex; petiole of cubitus less than one fourth as long as posterior branch of cubitus.

Female.—Antenna shorter than thorax, basal joint small, surface hairs of moderate length, apical joint swollen. Mesonotum as in the male. Abdomen stout, surface hairs very short. Legs proportions as in male, but fore tarsus nearly bare. Wing broader than in male; cross vein slightly before middle; costa extending very nearly to the apex; petiole of cubitus about a third as long as posterior branch; surface hairs more conspicuous than in male.

Length, 3–4 mm.

Illinois localities: East St. Louis, July 18, 1906; Vergennes, August 12, 1914 (R. Grizzell); Havana, September; and Matanzas Lake, Havana, August 24, 1894 (pupa).

Originally described from Europe. Specimens in Laboratory collection from localities outside of this state are from Lake Delavan, Wisconsin, September 1892, Grand Junction, Mich., July 1914 (C. A. Hart), and from Brownsville and Lake Lomalta, Texas, November (C. A. Hart).

One of the East St. Louis specimens was reared, but the larval skin was not preserved. Amongst the material saved from the breeding cage I found a single cast pupal skin, from which the drawings here given were made.

When I first commenced this work on *Chironomidæ* I considered it strange that Johannsen's drawing of the respiratory organ of *Tanypus monilis* should appear so different from that which Meinert gives for the same species. I had no difficulty in associating Johannsen's figure with the pupa which I obtained from the Illinois River material

in which *monilis* occurred commonly, but only when going over some material obtained near East St. Louis was I able to identify Meinert's species, which proves to be *Protenthes punctipennis*. A lengthy description of the pupa is unnecessary, as the figures present the characters for their differentiation more clearly than a word description could do. Meinert evidently misidentified his specimens—a not uncommon failing with workers in this group.

Mr. Hart captured at Little Bear Lake, near Grand Junction, Mich., July 15, 1914, both sexes of a very dark variety of *punctipennis*. The ground color of the body is pale brown, the darker portions blackish, and the wing-markings dark gray. The male taken at Vergennes, Ill., August 12, 1914, by Mr. Grizzell agrees in color with those taken in other Illinois localities earlier in the year. As I can find no structural differences between the specimens I consider them merely as color varieties of the same species.

3. Protenthes culiciformis Linné

Tipula culiciformis Linné, Syst. Nat. ed. 12, 1767, p. 978.

Larva.—Length, 4–5 mm. Pale yellowish buff, with a dark brown dorso-central line, which is interrupted anteriorly and posteriorly, a rather paler latero-dorsal line, and a cross band of same color on each suture, giving the larva a distinctly checkered appearance. Head buff, apices of mandibles and labial plate dark brown. Head about 1.5 times longer than broad, under side as shown in Figure 7, Plate XXVI. Antennæ much shorter than usual in this genus, barely longer than mandible (Pl. XXIV, Fig. 3); maxillary palpi as in Figure 4; labium often exposed (Pl. XXV, Fig. 8), its lateral basal process fringed; hypopharynx brown and usually very distinct, its anterior margin with about eight rounded teeth on each side; mandible with the apical half forming a sharp slender tooth, the projection at middle of inner surface of mandible pale, toothlike, projecting almost parallel with the apical tooth. Anterior pseudopods with numerous soft yellow hairs at apices, those at center slightly stouter and thornlike, but not in the form of claws; abdominal segments with numerous very fine hairs on sides, which are only visible under a high-power lens; posterior pseudopods of moderate length, armed at apices with long claws, which are uniformly pale brownish; anal tufts consisting of about ten sensory hairs each, their bases inserted in papillæ which are about three times as long as thick.

Pupa.—Length, 3.5–4 mm. Yellow to pale brown, the abdomen marked somewhat similarly to that of the larva. Thoracic respiratory

organ as in Figure 11, Plate XXIV; abdominal segments covered with short broad spinules, which become stronger posteriorly on each segment; apical abdominal appendages obtusely rounded, their margins externally fringed with short, broad, scalelike hairs, two long lanceolate hairs near the base of each.

Imago; Male and Female.—Yellowish brown, appearing almost black sometimes. Head blackish brown, antennæ, antennal plumes, and palpi grayish black. Mesonotum with the vittæ very broad, so that the whole disc appears blackish, the surface light gray pollinose; pleuræ with a large yellowish membranous area at center above, the remainder brown, subshining; scutellum obscurely yellow; postnotum brown. Abdomen almost entirely obscured with blackish brown, only the posterior margins of segments yellowish. Legs varying from yellow to brown, with apices of tibiæ, metatarsi, and second joints, and remaining tarsal joints brown, or almost entirely fuscous, with the apices black. Wings as stated in key. Female with the light and dark portions more sharply defined than in the male.

Male.—Basal joint of antenna large, globular; last joint cleft, about twice as long as remaining joints of flagellum combined, plumes dense and long. Mesonotum with sparse short pale hairs on spaces between vittæ, and more noticeable hairs of same color in front of wing-base. Hairs on abdomen dark, rather numerous but not very long; hypopygium as in Figure 5, Plate XXVIII. Legs long and slender, fore metatarsus two thirds as long as fore tibia and as long as the next three joints together; the surface hairs short but distinct; fourth tarsal joint on all legs longer than fifth. Petiole of cubitus subequal in length to the posterior branch of cubitus; costal vein reaching well beyond end of radius and round curved apex of wing.

Female.—Antenna very much shorter than thorax, basal joint much smaller than in male, last joint slightly swollen, surface hairs short. Hairs in front of wing-base more numerous, stronger, and darker than in male. Abdomen moderately stout, surface hairs pale and weak. Legs stouter than in male; basal joint of fore tarsus two thirds as long as fore tarsi; surface hairs very short. In other respects as male.

Length, 3.5–4 mm.

Illinois localities: Algonquin, Dubois, St. Joseph, Urbana, Carmi, Havana. Months of occurrence, April, May, and October. Specimens taken by Mr. Hart at South Haven, Mich., bear the date July 14, 1914. The species occurs commonly at light.

Dates affixed to specimens in the collection of the U. S. Bureau of Biological Survey range from April to July 30, which seems to indi-

cate a continuous occurrence throughout the warmer portions of the year. The species is abundant in Europe, including the British Isles.

A large number of specimens of both sexes of this species were reared from larvæ found in Salt Fork at Homer Park, Ill., March 21, 1914. The larvæ made slight cases amongst the debris in the bottom of the vials in which I placed them, but generally transformed to pupæ outside of them. Their peculiar jerky movements during the pupal stage when swimming distinguish them readily from other *Chironomidæ*, which is also true of the *Tanypinæ* in general, but this characteristic is of no use in classifying alcoholic material. Although the only food available for the larvæ that I tried to rear was dead vegetable matter, nearly all became adults, the few that died being killed by a water mold or similar agency. The pupal stage lasted about three days.

Larvæ were obtained from the Illinois River or connected waters as follows: Horshor Slough, Peoria Lake; Averyville, river channel; Havana, along shore on both sides of river and Matanzas Lake; Stewart's Lake; Meredosia; and mouth of McGhee Creek. A few larvæ were also obtained from Spoon River.

4. Protenthes choreus Meigen

Tanypus choreus Meigen, Klass. u Beschr. d. Europ. Zweifl. Ins., 1804, 1: 23, 6.

Male.—Coloration identical with that of *culiciformis*, except that the wings show a very faint suffusion on the apical half, and the cross vein, with the region immediately adjoining it, is suffused with fuscous.

The principal distinctions between this species and *culiciformis* may be summarized as follows: hypopygium differing in the shape of the apical portion of lateral arm (Pl. XXVIII, Figs. 4, 5); fore tarsus with long and dense hairing, the length of which exceeds at longest part three times the diameter of the tarsal joints. In other respects similar to *culiciformis*.

Length, 4 mm.

I have seen only two examples of this species. These are from Lake Delavan, Wis., but in all probability it occurs in Illinois also. The early stages are unknown to me.

5. Protenthes claripennis, n. sp.

The male of this species resembles very closely that of *culiciformis*, differing in having the legs entirely black, the hypopygium with the apical portion as in Figure 7, Plate XXVII, and the wings

clear. The female has much the appearance of that of *riparius* but is rather larger and more robust, the antennæ are blackish, the abdomen is almost entirely black, the segments having only very inconspicuous pale posterior margins, and the black color of the legs extends more over the various joints. The male differs from *choreus* in having the fore tarsi bare, and the proportions of basal joint and tibia different.

Length: male, 4–4.5 mm.; female, 3.5–4 mm.

Type locality, South Haven, Mich., July 14, 1914. Taken by Mr. Hart on shore of Lake Michigan.

6. Protenthes bellus Loew

Tanypus bellus Loew, Berl. Ent. Zeitschr., Vol. 10, 1866, p. 4.

Larva.—Length, 5–6 mm. Yellow. Labial plate, apices of mandibles, and claws of pseudopods brown, abdominal segments slightly brownish on dorsum.

Labial plate with the teeth similar to those of *monilis,* the lateral basal process as in *Protenthes culiciformis*; hypopharynx exposed as in the latter species, 7–8 toothed; mandibles as in *monilis;* antennæ short and rather thick, in length less than one third that of head and about five times that of their basal diameter, the jointed apical portion barely longer than the diameter of basal joint at apex, the apex of the former with several short processes, the unjointed process on apex of basal joint as long as the jointed portion and almost as thick; maxillary palpi short, barely more than twice as long as the diameter. Claws of anterior pseudopods very numerous and much weaker than those of the posterior pair, those of the latter unicolorous, mostly slender, those of the subapical circle broader (Pl. XXVI, Figs. 9, 10); dorsal tufts consisting of sixteen sensory hairs, the basal papillæ three times a long as thick.

Pupa.—Length, 4–5 mm. Brownish yellow. Thoracic respiratory organ as in Figure 9, Plate XXVII; no distinguishable thoracic tubercles. Abdomen without distinguishable hairs on dorsum, lateral margins of penultimate segment with three long, slightly flatttened hairs, last segment with five such hairs; apical appendages as in Figure 12, Plate XXVI.

Imago; Male and Female.—Pale rufous yellow, opaque. Head yellow, antennæ pale brown, basal joint in male dark brown, in female generally yellow, plumes of male antenna yellowish brown. Mesonotum with the vittæ pale reddish, rarely reddish brown; scutellum yellow; postnotum the color of vittæ. Abdomen yellow, all the seg-

ments with anterior marginal bands of a brownish color, which become considerably broader from middle to apex of abdomen in male, but are of almost uniform width on all segments in female. Legs pale yellow; apices of tibiæ, of first two tarsal joints, and whole of remaining tarsal joints dark brown. Wings clear; cross vein clouded. Halteres yellow.

Male.—Antenna appreciably longer than head and thorax combined, plumes conspicuous and closely placed. Mesonotum with weak, pale hairs between vittæ and in front of wing-base; scutellum with similarly colored, longer hairs. Abdominal hairs pale and rather long; hypopygium as in Figure 12, Plate XXVIII. Legs slender; fore tarsus with basal joint about two thirds as long as fore tibia and as long as next three joints combined; no long surface hairs on tarsus or mid and hind legs; fourth tarsal joint elongate, subequal in length to fifth. Wing venation very similar to that of *culiciformis,* apical portion of R_3 weak beyond R_2 (the cross vein); petiole of cubitus subequal to posterior branch of cubitus; surface hairs of wing almost indistinguishable.

Female.—Similar to male, but with the usual sexual distinctions. The antenna is distinctly shorter than the thorax, the basal joint is much less swollen than in the male, the apical joint is distinctly swollen, and the surface hairs are very short, being barely longer than the diameter of the antennal joints. Body rather stout. In other respects similar to male.

Length, 2.5–3 mm.

Several specimens of this species have been taken at Havana, on the Illinois River, and also at Urbana, during April and May. Examples in the collection of the Bureau of Biological Survey were taken at Washington, D. C., in May and June by W. L. McAtee.

The larval and pupal stages are described here for the first time. The material was obtained by the writer at Havana.

This species was originally described from Washington, D. C., and was not known to Johannsen when he wrote his paper, already referred to, on the *Chironomidæ.*

7. Protenthes riparius, n. sp.

This species is very similar to the foregoing; in fact so similar that at one time I regarded it as only a color variety of *bellus.* The characters separating it from that species are given in the following paragraph.

Male and Female.—Pale lemon-yellow, opaque; thoracic vittæ black, slightly gray pollinose on surface; abdomen with only the pos-

terior margins narrowly, but conspicuously, pale lemon-yellow in male, but with the pale and dark colors almost equally divided in the female; the legs with but little indication of pale color at base of second tarsal joint, appearing infuscated from apex of basal joint to their tips. In other respects similar to *bellus* except that the hypopygium is as represented in Figure 7, Plate XXVIII, and that generally the insect is a little larger, averaging 3.5 mm.

Localities: type, Thompson's Lake, Havana, May, 1912; paratypes, same locality, April 19, 1898, and April 30 and May 1, 1912; allotype, Havana, April 20, 1898.

The larva and pupa are unknown to me.

I do not consider it probable that the foregoing can possibly prove to be a color variety of *bellus;* but even in the event of such proof being forthcoming it will be necessary to retain the varietal name. There is, however, in the mount of *bellus* which I have prepared a good distinction from *riparius* in the shape of the apical portion of the lateral arm of the hypopygium, and this should, I think, entitle the two species to separation, though in other respects, except color and size, they are almost identical.

Procladius Skuse

The imagines of this genus may be separated from those of *Tanypus* and *Protenthes* by the absence of the surface hairs from the wings. It is, however, difficult to detect the hairs in some species of *Protenthes,* but I consider it highly probable that the obcordate fourth tarsal joint and bare wings will be found together, and that the species with the elongate fourth tarsal joint will invariably have surface hairs on the wings, though at times it will be difficult to distinguish them. I have not at the present time sufficient material to permit my making a definite statement on this point, but the species which I have in hand justify this opinion, and that is as far as I can go safely. Were it not for the fact that Johannsen has described the larva of *Procladius adumbratus* as being almost identical with that of *Protenthes culiciformis* I should suggest that the shape of the labial plate of *Procladius concinnus* furnishes a character for distinguishing the larvæ of this genus from those of *Protenthes.* I may also mention that the *Procladius* larvæ I have seen are invariably red or reddish, while the other genera have invariably whitish yellow or brownish larvæ. However, unless Johannsen confused his material this rule will not hold.

Keiffer has erected a new genus *(Clinotanypus,* Rec. Ind. Mus., Vol. 9, 1913, p. 157) for species with the fourth tarsal joint obcordate, retaining the name *Procladius* for species having the fourth tarsal joint linear. I have not seen Skuse's original description of *Procladius,* and for the time being retain this name for our species, although our species have the fourth tarsal joint obcordate.

The keys given herewith will serve to distinguish the imagines of the Illinois species of *Procladius.*

Key to Species

FEMALES

1. Fourth tarsal joint elongate; small yellow species, 3–3.5 mm.; mesonotum with 3 reddish vittæ.....*Protenthes bellus**.
— Fourth tarsal joint obcordate; larger species, 4–4.5 mm.....2
2. Petiole of cubitus one third as long as lower branch of that vein.. .....1. *thoracicus.*
— Petiole of cubitus about as long as its own diameter.....3
3. Mesonotum with the disc glossy black, lateral anterior margins and prescutum creamy white.....2. *scapularis.*
— Mesonotum reddish yellow with 3 reddish vittæ, the posterior extremities of the lateral vittæ and a spot on each side of scutellum deep black.....3. *concinnus.*

MALES

1. Fourth tarsal joint elongate.....*Protenthes bellus**.
— Fourth tarsal joint obcordate.....2
2. Abdomen black and white annulate, petiole of cubitus extremely short .....2. *scapularis.*
— Abdomen with apices of segments pale, but not conspicuously annulate 3
3. Petiole of cubitus one third as long as lower branch of that vein. .....1. *thoracicus.*
— Petiole of cubitus about as long as its own diameter..... .....3. *concinnus.*

1. Procladius thoracicus Loew

Tanypus thoracicus Loew, Berl. Ent. Zeitschr., Vol. 10, 1866, p. 4.

Male.—Yellow, shining. Head yellow, obscured with brownish; antennæ brown, plumes pale brown; face and palpi yellow. Thorax

*For description see p. 388. See also p. 382.

shining yellow; mesonotum with the vittæ blackish brown, very broad, almost obscuring the pale ground-color; only the upper central portion of pleuræ yellow; scutellum and postnotum blackish brown; hairs on thorax pale brown. Abdomen blackish brown, yellowish at the incisions. Legs yellow; apices of femora and bases of tibiæ slightly brownish; apices of all tibiæ dark brown; apices of basal and whole of remaining joints of fore tarsi, apices of first two and all of the last three joints of mid and hind tarsi dark brown. Wings clear, cross vein brown, the other veins yellow. Halteres yellow.

Antennæ barely longer than head and thorax together, densely plumose, basal joint much swollen. Mesonotum with the surface hairs very short, those on scutellum barely longer than the discal hairs. Abdomen slender, slightly spatulate at apex; hypopygium as in Figure 9, Plate XXVIII; surface hairs short and numerous. Legs slender; basal joint of fore tarsus barely over half as long as fore tibia, and subequal in length to the next three taken together; no long hairs on fore tarsus; fourth tarsal joint on all legs obcordate. Radius reaching slightly beyond the beginning of apical curve of wing; petiole of cubitus half as long as posterior branch of cubitus.

Female.—Similar in general color and markings to the male, but considerably more of the reddish yellow ground-color of head is visible, as the brown color is absent except on the apical half of antennæ; the thorax is also much paler, the vittæ being reddish except centrally, where they become brown, being sometimes entirely brown, when the resemblance to the male becomes more apparent; scutellum yellow; postnotum brown apically. Abdomen shining dark brown. Legs as in male. Wing veins more distinct than in male.

Antenna distinctly shorter than thorax, third joint as long as 4+5, apical joint slightly longer than third, slightly swollen, surface hairs about twice as long as diameter of the joints; eyes much more widely separated than in male. Thorax with hairs as in male. Hairs on abdomen very short. Leg proportions as in male, as also wing venation.

Length, 4.5–5 mm.

Localities: Algonquin, Ill., June and August; and Havana, on the Illinois River, during the months April to July and as late as September 21. The species probably occurs throughout the warm months of the year.

Originally described from Washington, D. C., and recorded from New Jersey by Smith.

The early stages are unknown to me.

2. Procladius scapularis Loew

Tanypus scapularis Loew, Berl. Ent. Zeitschr., Vol. 10, 1866, p. 2.

Male.—Black, subopaque. Head white behind and above eyes; antennæ black, the plumes on the basal two-thirds pale brown, on apical third almost black, apical joint with white hair. Pronotum, lateral margins of mesonotum anterior to wing-base, and almost the whole central and anterior portion of pleuræ creamy white; scutellum and postnotum black. Abdomen black with three yellowish white bands, a broad one at base, a much narrower one at middle, and the third on the apical half of the sixth segment; apical portions of hypopygium white. Legs black; coxæ at apices, trochanters and bases of femora, tibiæ except bases and apices, and the basal two-thirds of first tarsal joint of all legs whitish yellow. Wings clear, cross vein blackened. Halteres pale yellow.

Antenna slightly longer than head and thorax together, basal joint much swollen, plumes long and dense. Mesonotum with short discal hairs, those on lateral margins in front of wing-base most distinct; scutellar hairs not strong. Abdomen with numerous short surface hairs; hypopygium as in Figure 8, Plate XXVIII. Legs slender; fore tarsus without long hairs, its basal joint two thirds as long as fore tibia, and distinctly longer than the remaining joints combined; fourth tarsal joint on all legs obcordate. Costa reaching almost to apex of wing; radius reaching well round the curve at apex; petiole of cubitus barely longer than its own width.

Female.—Similar to male in coloration, except that the head is almost entirely yellow, and the antennal hairs are unicolorous brown; the abdomen is unicolorous black except the base of venter, which is yellowish; the fore legs are entirely black except the bases of the femora, and the yellow tibial bands are much narrower.

The antenna is very much shorter than the thorax, the basal joint slightly swollen and the apical joint very slightly so, the surface hairs are very short. Thorax as in male. Abdomen stout. Leg proportions as in male, and also the wing venation.

Length, 3.5–4 mm.

Localities, Savanna, Ill., July 20, 1892, and Havana, Ill., August 8, 1896. All females.

The only males I have seen belong to the collection of the Bureau of Biological Survey, and were taken at Washington, D. C., and on Plummer's Island, Md., by W. L. McAtee.

The species was originally described from Washington, D. C., and has been subsequently recorded from New Jersey by Johannsen.

The early stages are unknown to me.

3. Procladius concinnus Coquillett

Tanypus concinnus Coquillett, Proc. Acad. Nat. Sci. Phil., 1895, p. 308.

Larva.—Length, 6.5–8 mm. Blood-red. Head about 1.5 times as long as broad; labrum as in Figure 12, Plate XXV; antenna about half as long as head, basal portion about six sevenths of the entire length (Pl. XXIV, Fig. 15); mandible brown at apex, central tooth on inner surface poorly developed; labium as in Figure 6, Plate XXV; labial papillæ as in Figure 9, Plate XXV; maxillary palpus as in Figure 6, Plate XXIV; eye spot double, the spots almost confluent. Anterior pseudopods short and stout; abdominal segments with numerous very fine hairs; posterior pseudopods short and stout, their apices with pale brown claws; dorsal respiratory organs stout, with two distinct hairs just above their bases; dorsal tuft with about twenty long sensory hairs, the basal papillæ about twice as long as thick, dorsal view of anal segments as in Figure 15, Plate XXVI.

Pupa.—Length, 5–6 mm. Reddish, becoming brownish as the time for emergence of the adult approaches. Respiratory organ as in Figure 4, Plate XXVII (part of the trachea shown); a short transverse row of minute tubercles extending from near the base of each respiratory organ towards the mesial line. Slightly beyond the middle of the lateral margin on each segment there is a small wartlike protuberance armed with hairs as shown in Figure 6, Plate XXVI; lateral margin of penultimate segment with eight long lanceolate hairs, serially arranged on the apical four-fifths; last segment with a patch of microscopic setulæ on the dorsal surface near base, and five long, lanceolate, lateral hairs; apical appendage elongate, rounded at apex, the two lanceolate hairs not very broad, the small marginal hairs extraordinarily numerous and very fine.

Imago; Male and Female.—Pile yellowish buff, slightly shining. Head and its appendages yellow, in female sometimes brownish; antennal plumes in male yellow. Mesonotum with the vittæ reddish, the vitta on each side in male with its outer margin broadly black from middle to posterior extremity, the central vitta in female generally with the lateral margins blackened and the black color of the lateral pair confined to the apices; scutellum with a black spot on each side; postnotum black on center or entirely black; disc of mesonotum in male noticeably white pollinose between the vittæ; pleuræ immaculate, or with a brownish spot below wing-base. Abdomen with a brown band at bases of segments two to six in male, the band in female often reduced to a transverse series of three spots on each segment. Legs yellow, a narrow ring at apices of all tibiæ and at apices of basal joint

of all tarsi brown, all tarsi from apices of second joint obscured with brown. Wings clear, cross vein distinctly infuscated. Halteres yellow.

Male.—Antenna as long as head and thorax together, basal joint much swollen, last joint about one and a half times as long as rest of flagellum, plumes very long and dense. Mesonotum almost bare, the hairs between vittæ very weak; a small group of rather short hairs close in front of wing-base. Abdomen with quite long and rather numerous pale hairs; hypopygium as in Figure 6, Plate XXVIII. Legs rather slender and without long hairs; basal joint of fore tarsus about two thirds as long as fore tibia and distinctly longer than the remaining joints combined; fourth tarsal joint of all legs obcordate. Wing venation as in preceding species.

Female.—Structurally almost identical with the female of the preceding species.

Length, 4.5–5 mm.

Illinois localities: Urbana, July 2, 1887 (C. A. Hart), and September 5, 1914 (J. R. Malloch); Havana, August and September, several of the speciments at light. Larvæ occur commonly in the Illinois River as far north as Ottawa, and in the numerous connected lakes.

Originally described from Tick Island, Fla., and not subsequently recorded as far as I am aware.

Psilotanypus Kieffer

As far as our present knowledge goes, this genus is represented in North America by only a single species, *occidentalis* Coquillett. The immature stages are unknown.

Psilotanypus occidentalis Coquillett

Tanypus occidentalis Coquillett, Proc. U. S. Nat. Mus., Vol. 25, 1902, p. 92.

Male.—Brownish black, subshining. Head fuscous, including the antennæ and their plumes, face yellowish. Pronotum, anterior margins of mesonotum, upper central portion of pleuræ, and scutellum yellowish. Venter of abdomen yellowish, dorsum black. Legs brownish, tibiæ and tarsi, except their apices, paler. Wings clear, veins brownish. Halteres yellow.

Pronotum rather wide, central excision weak. Hypopygium with distinct, acute extension of dorsal plate, apical portion of lateral arm recurved. Legs slender, fore tarsi with moderately long sparse hairs, basal joint four fifths as long as fore tibiæ; fourth tarsal joint on all legs linear, longer than fifth; pulvilli absent; empodium small. Vena-

tion similar to that of *Protenthes* (Pl. XXVII, Figs. 2, 5), differing in the absence of the fork at apex of first vein; cubitus forking about as far beyond cross vein as the length of that vein.

Length, 4.5 mm.

Locality, South Haven, Mich., July 14, 1914, on shore of Lake Michigan (C. A. Hart).

This species resembles *Diamesa waltlii* in color and size, but differs in venation and in having the fourth tarsal joint linear.

The foregoing description differs from that given by Coquillett in color of legs, an unimportant detail, and as the original description is very brief it is not possible to identify the present species with absolute certainty.

Originally described from Colorado, and subsequently recorded from New Jersey by Johnson.

Cœlotanypus Kieffer

The genus *Cœlotanypus* is a rather arbitrary one, and its status could readily be questioned, since the species which have a short petiole to the cubitus show so much variation in its shortness that I should expect the petiole to be absent in individual cases. I have found it a general rule in *Diptera*, as well as in other orders, that where the petiole of a vein is very short, or where two veins meet another vein in close proximity to each other, the tendency is to considerable variation in the comparative length of the short portions of the veins in different specimens, or even on the wings of the same specimen. This genus is retained here more for convenience and a desire to avoid confusion than because I consider it entitled to separation from *Procladius*. Johannsen suggested in his paper on this group in 1905 that *tricolor* belonged to *Anatopynia*, but in 1913 Kieffer erected the genus *Cœlotanypus* for this species and *humeralis* Loew, the basis of separation being the shape of the fourth tarsal joint. *Anatopynia* as restricted by Kieffer does not occur in North America, Johannsen having indicated as the type of the genus *Tanypus plumipes* Fries, a European species not known to occur in North America.

Cœlotanypus tricolor Loew

Tanypus tricolor Loew, Berl. Ent. Zeitschr., 1861, Vol. 5, p. 309.

Female.—Glossy yellow. Head slightly brownish. Mesonotum with the vittæ reddish or brownish, becoming black on the outer margins; anterior lateral margins of mesonotum and anterior half of pleuræ creamy white but not so conspicuous as in *scapularis;* scutellum

and postnotum dark brown. Abdomen brown with the posterior margins yellow, those of segments two and six conspicuously so. Legs yellow, with the following parts brown: an indistinct broad band on middle, and a narrower darker one at apices, of femora; a broad band extending from near base to middle and a narrower one on apices of all tibiæ; the fore tarsi from apical third of basal joint to its tip; the apex of basal tarsal joint and from apex of second joint to the tip of tarsi on mid and hind legs. Wings clear, cross vein infuscated. Halteres yellow.

Almost identical in structure with the female of *scapularis,* but rather larger and more robust. The basal joint of fore tarsus is slightly more than half the length of fore tibia and distinctly, though not greatly, shorter than the remaining tarsal joints combined. The petiole of the cubitus is not distinguishable, though the fork is not proximad of the cross vein. In other respects almost as *scapularis.*

Length, 4.5 mm.

Illinois locality, Havana, July 5, 1894; two females reared from larvæ taken from the Illinois River at this place. The larval and pupal exuviæ were not saved. Specimens of larvæ which from their general appearance were considered to belong to this species had been previously preserved in alcohol, but for obvious reasons they can not be definitely associated with the adults. The writer took a female specimen at Havana June 15, 1914.

Originally described from New York, and not subsequently recorded as far as I am aware.

Unidentified Larvæ of Tanypinæ

During the years 1912–13 a large amount of material representing larvæ and pupæ of this subfamily and the other subfamilies of *Chironomidæ* was obtained by dredging in the Illinois River, but no attempt was made to rear imagines from it owing to the press of other matters. In order to complete this work of identification as far as possible under the circumstances, and to enable any future worker on Illinois *Chironomidæ* to associate these larvæ with imagines which may subsequently be reared from larvæ possessing the same characters, a brief description of two species is given here, with a list of localities for each.

Tanypus sp. A

This species is very close to *monilis,* but differs noticeably in the form of the labial plate (Pl. XXV, Fig. 2) and in the structure of the palpus and antenna (Pl. XXIV, Figs. 12, 13). Mandible as

shown in Figure 17, Plate XXIV; labial papillæ as in Figure 4, Plate XXV.

Localities, Meredosia, Naples, La Grange Lock, and Grafton—all on the Illinois River.

Tanypus sp. B

Length, 5 mm. Labial plate as in Figure 5, Plate XXV; body slightly flattened; head parts pale in color; antenna and maxillary palpus as in Figures 8 and 9, Plate XXIV; posterior pseudopods not much elongated; anal respiratory organs large, not acute at apices, the dorsal pair of hairs present; dorsal tuft with about twelve hairs, the papillæ about five times as long as thick.

Localities, Averyville, Pekin, Havana, Thompson's Lake, Matanzas Lake, Meredosia, and La Grange Lock—all on or connected with the Illinois River.

CHIRONOMINÆ

The species included in the *Chironominæ* form a more complex group than do those contained in the other two subfamilies, but, nevertheless, one which nowhere lends itself to a satisfactory subdivision which will apply to all stages, and lacking this I do not consider it expedient to subdivide them except in the imago stage. Many quite striking larval characters are found in species the imagines of which are so similar to others which do not possess these larval characters that they are separable with difficulty, while, on the other hand very dissimilar imagines have often very similar larvæ. The presence of the medio-cubital cross-vein of the wing in *Diamesa* at once distinguishes the imago from any other chironomine species and seems to link it closely with *Tanypinæ*, but the antennal difference between the sexes and the type of larva unmistakably point to its closer affinity with the present group. The case-forming habit of the genus *Tanytarsus* is an elaboration of the burrowing habit of other chironomid species, which, taken in conjunction with the hairy wings of the imagines indicates a good generic distinction from their closest relatives. Many of the generic divisions are perfectly sound, but within the last few years some arbitrary divisions have been proposed, notably by Kieffer, which may be very useful to systematists who can appreciate the minutiæ of the distinctions, but which are, I am confident, not in keeping with the natural grouping of the species. This conviction must impress itself upon any one who studies the larval and pupal stages, which, in nearly all orders, furnish a better basis for classification than do the imagines. In the present paper the object which has

been kept in view is principally that of presenting a classification whereby the *Chironomidæ* occurring within the State of Illinois may be readily identified. It has, however, been necessary, particularly in this subfamily, to examine a large number of species which are not represented in the collection of the State Laboratory of Natural History, and this paper presents certain facts ascertained from an examination of species not known to occur in the state because they seem to support deductions arrived at from an examination of Illinois species.

The larvæ of the different genera are very similar in appearance and, as already indicated, do not seem to lend themselves to generic classification. The "blood-worms" do not belong exclusively to the genus *Chironomus,* as some species of *Tanypinæ* are blood-red. It is not the case that red larvæ have invariably ventral blood-gills on the eleventh segment in the genus *Chironomus* as stated by Johannsen.* Several blood-red species of Chironomus have no ventral blood-gills, though I do not know of any species of another color which possesses these organs.

I have included in a single key all the larvæ of this subfamily known to me, considering it probable that they may thus be more readily identified.

The pupæ of the genus *Chironomus* are readily separable from those of any other genus by the numerous hairlike filaments of the thoracic respiratory organs. The other genera, however, are very similar in general appearance, and, considering the small number of species which I have examined that are represented in all stages, it would be unwise to propose in this paper any method of separation of the pupæ on a generic basis. That characters exist which may be used for the purpose of generic subdivisions I have no doubt, but no advantage is to be gained by such a course when the paucity of available data would in all probability lead to a confusion of generic and specific characters.

The imagines of some genera are very closely allied to each other, and in certain cases, *Camptocladius* and *Orthocladius,* for example, the genera are almost inseparable. I have endeavored to make the distinctions clear, and have refrained from elaboration in description, depending largely on illustrations, which are more easily comprehensible than the most lucid description. Many characters which have either been ignored or overlooked by previous writers on the family have been introduced in this paper, but the anatomical details have by no means been exhausted.

*Aquatic Nematocerous Diptera, Bull. 86, N. Y. State Mus., 1905, p. 181.

In a recent paper* Kieffer has divided the *Chironominæ* (*Tendipedinæ*) into three groups, *Clunionariæ*, *Orthocladiariæ*, and *Tendipedariæ*, using as the principal character for their separation the presence or absence of the apical comb on the hind tibiæ, or the form of that comb. I have not followed Kieffer in this respect, partly because I am not satisfied with his basis for the separation, but chiefly because I believe that the present classification will enable students to recognize the species dealt with in this paper more readily than that proposed by Kieffer, with its many subdivisions.

Key to Genera

1. Medio-cubital cross-vein present.....*Diamesa* (p. 410).
— Medio-cubital cross-vein absent.....2
2. Fourth tarsal joint obcordate, shorter than fifth.....3
— Fourth tarsal joint cylindrical, generally longer than fifth.....5
3. Third tarsal joint subequal in length to fourth.....*Paraclunio*†.
— Third tarsal joint conspicuously longer than fourth.....4
4. Wing venation normal, first and third veins not conspicuously thickened at apices, ending well beyond middle of wing; male antennæ with 15 joints.....*Thalassomyia* (p. 411).
— Wing of female with the appearance of having a stigma, first and third veins conspicuously thickened on apical portion, ending about wing middle; third vein ends much in front of apex of wing in male; male antennæ with 13 joints....*Corynoneura*‡ (p. 413).
5. Basal joint of fore tarsi subequal to or appreciably longer than fore tibiæ; apical portion of lateral arm of hypopygium not recurved, simple, without thornlike process on inner side at apex..6
— Basal joint of fore tarsi not as long as fore tibiæ, generally very much shorter; apical portion of lateral arm of hypopygium nearly always recurved and armed at apex on inner side with one or more short thornlike processes.....7
6. Wings bare; third vein rarely *(subæqualis* and *pseudoviridis)* ending at a point farther in front of apex of wing than fourth ends behind it .....*Chironomus* (p. 414).

*Rec. Ind. Mus., Vol. 9, 1913, p. 120.

†The genus *Paraclunio* Kieffer was erected with *trilobatus* Kieffer as the only species. This species is a synonym of *Telmatogeton alaskensis* Coquillett, the latter being placed in a wrong genus by Coquillett. The synonymy will thus stand as follows:

Paraclunio alaskensis (Coquillett), the present paper.
Telmatogeton alaskensis Coquillett, Proc. Wash. Acad. Sci., Vol. 2, 1900, p. 395.
Paraclunio trilobatus, Kieffer, Bull. Soc. d'Hist. Nat. de Metz, Ser. 3, Vol. 3, p. 103.

‡*Corynoneura* is stated by Kieffer to have 11 antennal joints in the male.

— Wings with distinct surface hairs; third vein ending appreciably farther in front of apex of wing than fourth ends behind it..... .....*Tanytarsus* (p. 484).
7. Wings with distinct surface hairs.....*Metriocnemus** (p. 497).
— Wings bare 8
8. Thorax with a distinct longitudinal furrow; antennæ in both sexes short-haired and with 7 joints (2+5)..*Chasmatonotus* (p. 499).
— Thorax without median furrow; antennæ of male with more than 7 joints 9
9. Apical portion of lateral arm of hypopygium not recurved, unarmed at apex on inner side (Pl. XXXVII, Fig. 16)..... .....*Pseudochironomus*† (p. 500).
— Apical portion of lateral arm of hypopygium recurved, generally armed on inner side at apex with one or more thornlike processes 10
10. Legs conspicuously bicolored, black and white; eyes hairy..... .....*Cricotopus* (p. 501).
— Legs not conspicuously bicolored, either black or brown, or if paler without sharply contrasted colors.....11
11. Posterior branch of cubitus conspicuously bisinuate (Pl. XXXV, Fig. 9).....*Camptocladius* (p. 507).
— Posterior branch of cubitus either straight or slightly sinuous..... .....*Orthocladius*, sens. lat. (p. 512).

N. B. The genera *Tersesthes* Townsend and *Eutanypus* Coquillett are unknown to me.

Key to Larvæ‡

1. Eleventh segment with latero-ventral blood-gills, which are usually very long and situated low.....2
— Eleventh segment without blood gills.....7
2. Only one pair of blood gills on eleventh segment, situated high on side at posterior margin, and occasionally very short or even

Eurycnemus, which has been recorded from New Jersey, differs from *Metriocnemus* in having the mesonotum conically produced in front, and the hind tibiæ dilated and hairy. I have not seen Illinois specimens of this genus. A genus, *Brillia*, has been erected by Kieffer for the reception of those species of *Metriocnemus* that have the hypopygium with apical portion of lateral arm bifid. At least one American species belongs to *Brillia*.

†This genus is intermediate between *Chironomus* and *Orthocladius*, resembling the former in the structure of the hypopygium and the latter in venation and in having the basal joint of the fore tarsi conspicuously shorter than the fore tibiæ. The species described under the name *Chironomus pseudoviridis*, n. sp., in this paper shows a much closer approach to the typical *Chironomus*, and I therefore leave it in that genus though the length of the basal joint of the fore tarsi is not equal to that of the fore tibiæ, and the hind tibiæ have an apical spur instead of a comb of regular, closely placed spinules.

‡Species without page number are not treated in text.

absent; labium with the central tooth simple (Pl. XXIX, Figs. 7, 8) ..... *Chironomus lobiferus* (p. 430).

— Two pairs of blood gills present, situated low on sides and very long and noticeable; labium with the central tooth trifid, or the first lateral tooth very small 3

3. Central labial tooth either truncated at apex or but poorly defined, the separation between it and the first laterals very slight 4

— Central labial tooth either acutely pointed, or rounded at apex and with a more or less distinct shoulder on either side 5

4. The 3 central teeth almost fused (Pl. XXIX, Fig. 1), antenna with 6 joints (Pl. XXX, Fig. 10) ... *Chironomus flavicingula* (p. 432).

— The 3 central teeth distinctly divided; antenna with 5 joints ..... *Chironomus plumosus* (p. 447).

5. Large species, about 25 mm. in length ..... *Chironomus tentans?* (p. 444).

— Smaller species, not over 15 mm. in length 6

6. Central labial tooth slightly rounded or acute at apex, without a distinct shoulder (Pl. XXIX, Fig. 10) ..... *Chironomus viridicollis* (p. 457).

— Central labial tooth generally distinctly rounded and with a distinct shoulder ..... *Chironomus decorus* (p. 472).

7. Abdominal segments with a distinct pencil of hairs on each side near posterior margin in addition to a few scattered hairs ..... *Cricotopus trifasciatus* (p. 503).

— Abdominal segments without distinct pencil of hairs 8

8. Labium with the central portion pale, broadly rounded in outline, the lateral portions dark colored, heavily chitinized, and digitate (Pl. XXX, Fig. 13) ..... { *Chironomus digitatus* (p. 483). { *Chironomus* sp. C .... (p. 529).

— Labium and antenna not as above 9

9. Very large species, averaging 45 mm. in length ..... *Chironomus ferrugineovittatus* (p. 446).

— Much smaller species, not more than 12 mm. in length 10

10. Central labial tooth not divided in middle 11

— Central labial tooth divided in middle 29

11. First and second lateral teeth fused nearly to their apices, much more closely adherent than central and first lateral or second and third; or anterior outline of labial plate convex, never subtriangular 12

— First and second lateral teeth not closely united; or labial plate subtriangular 13

12. First and second lateral teeth fused nearly to apices ..... *Chironomus tenellus.*

— First and second lateral teeth separate for some distance from their apices ..... *Chironomus dux.*

13. First lateral tooth longer than central tooth 14

— First lateral tooth shorter than central tooth, or at most subequal to it 16

14. First lateral tooth very distinctly longer than central tooth and distinctly broader (Pl. XXIX, Fig. 22) ; basal joint of apical section of antenna dark, not longer than next joint (Pl. XXX, Fig. 8) ..... *Genus incertus* C (p. 533).

— First lateral tooth but slightly longer than the central one and not broader 15

15. Apical jointed portion of antenna slender, subequal in length to basal portion; stout species, with the body rounded in cross-section, and the segments not clearly defined..... ..... *Chironomus lobiferus* (p. 430).

— Apical jointed portion of antenna stout, distinctly shorter than the basal portion; slender, tapering species, the body segments slightly flattened and well defined..... *Cricotopus varipes.*

16. Central labial tooth and all except the first lateral truncated apically, first lateral very short, and acute at apex (Pl. XXIX, Fig. 5) ; mandibles without distinct teeth (Pl. XXX, Fig. 3) ; antenna as in Figure 6, Plate XXX..... *Chironomus* sp. B (p. 529).

— Labium not as above 17

17. Mandibles with two poorly defined teeth (Pl. XXX, Fig. 1), 3 very large labial teeth, the others short (Pl. XXIX, Fig. 15)..... ..... *Genus incertus* A (p. 532).

— Mandibles with well-developed teeth; labium otherwise than above 18

18. Central labial tooth very broad, at least twice as broad as first lateral tooth, central portion of labium paler than lateral portions 19

— Central labial tooth not twice as broad as first lateral; or the central portion of labium generally as dark as the lateral portions. 21

19. Central labial tooth regularly rounded, slightly more than twice as broad as second tooth, which is pale and rounded (Pl. XXIX, Fig. 21)..... *Orthocladius* sp. B (p. 531).

— Central pale portion of labium consisting of a very slightly rounded and very broad tooth without indications of indentations though not smooth apically 20

20. Sides of labium sloping very decidedly backward (Pl. XXIX, Fig. 17) ..... *Orthocladius* sp. E (p. 532).

— Sides of labium sloping but little backward (Pl. XXIX, Fig. 13).. ..... *Orthocladius* sp. A (p. 531).

21. Central tooth of labium very much longer and distinctly broader than first lateral, first lateral not shorter than second..... 22

— Central tooth of labium not broader than first lateral, first lateral sometimes shorter than second..... 27

22. Labial teeth very acutely pointed (Pl. XXIX, Fig. 3)..... ..... *Diamesa walllii* (p. 410).

— Labial teeth not acutely pointed.....23
23. Central tooth simple, regularly rounded.....24
— Central tooth with a distinct shoulder (Pl. XXIX, Fig. 19).....
.....*Tanytarsus exiguus* (p. 495).
24. Sides of labium diverging slightly, the outline of labium almost subtriangular.....25
— Sides of labium diverging widely, anterior outline slightly convex.....26
25. First lateral tooth simple, regularly rounded.....*Cricotopus exilis.*
— First lateral tooth fused with second so that latter appears to be a mere shoulder to the first.....*Orthocladius fugax.*
26. Antennæ remarkably elongated, their entire length rather more than equal to that of head.....*Tanytarsus dives* (p. 488).
— Antennæ not exceptionally long, shorter than head.....
.....*Tanytarsus* sp. C (p. 531).
27. First lateral tooth distinctly shorter than second lateral and central teeth.....*Chironomus dorsalis.*
— First lateral tooth not shorter than second.....28
28. Second antennal joint with 2 slender processes, which have their apices slightly enlarged, in addition to the normal continuation of the antenna.....*Tanytarsus exiguus* (p. 495).
— Second antennal joint with only one auxiliary process, which is sharp apically.....*Tanytarsus dissimilis.*
29. The bifid central tooth very short, flanked by a very broad portion which occupies about half the remaining area of labium, and is succeeded laterally by 4 or 5 short teeth; mandible very acutely pointed; apical jointed portion of antenna about a fourth as long as basal joint.....*Orthocladius flavus.*
— The bifid central tooth long and distinct, no large untoothed area on each side.....30
30. Central tooth shorter than second (Pl. XXIX, Fig. 6).....
.....*Chironomus fulviventris.*
— Central tooth not distinctly shorter than second.....31
31. The central 4 teeth of about equal size, the next one on each side distinctly longer and very distinctly darker, the 6 together forming a slightly concave anterior line, sides but slightly divergent posteriorly; basal hair remarkably long (Pl. XXIX, Fig. 23); antenna as in Figure 11, Plate XXX..*Genus incertus* B (p. 533).
— Labium not as above.....32
32. First lateral tooth very distinctly shorter than the central bifid tooth and second lateral, or sometimes closely fused with the former.....33
— First lateral tooth not very short, generally distinctly longer than second, the central tooth with a distinct shoulder in *Orthocladius nivoriundus*.....34

33. Antenna with 6 joints (Pl. XXX, Fig. 4) ..... *Genus incertus* D (p. 533).
— Antenna with 5 joints ..... *Chironomus flavus* (p. 474).
34. The four central teeth considerably paler than the lateral teeth, rounded apically, the outline of the four together forming a convex line, first lateral tooth beyond these distinctly longer and broader than the central pair 35
— Central pair of teeth much stronger than any other pair, or labial teeth not as stated above 36
35. Third tooth from median line (first dark tooth) very distinctly projecting beyond the anterior transverse line of the second tooth ... *Metriocnemus knabi.*
— Tooth mentioned above not projecting farther forward than the anterior transverse line of the second tooth (Pl. XXIX, Fig. 20) ... *Orthocladius* sp. C (p. 531).
36. Central pair of teeth with a distinct shoulder, the second tooth fused with first (Pl. XXIX, Fig. 16) ..... *Orthocladius nivoriundus* (p. 525).
— Central pair of teeth without a distinct shoulder 37
37. Central pair of teeth nearly twice as broad as the next pair, the latter longer than third pair ... *Metriocnemus lundbecki* (p. 498).
— Central pair of teeth not twice as broad as next pair, the latter not longer than third pair ..... *Chironomus nigricans* (p. 434).

The foregoing key is framed to include the previously described North American larvæ with the exception of those described but unidentified, and is not intended to serve as a guide to the separation of the species in the *decorus* group. There are several very closely allied species in this group which it will be necessary to rear in considerable numbers, and any careful student with time to devote to the work should find some interesting problems in differentiating the species in the larval and pupal stages. The species of this group all have red larvæ with long respiratory organs on the sides of the eleventh segment, and probably there are in all more than half a dozen closely allied species which are much more readily separated in the imaginal stage than in either the larval or pupal stages. But few reared specimens of this group are available for study here, and therefore I make at present no attempt to associate the species in their different stages.

The form of the labial plate has been used as a convenient means of separating the species and is generally very constant in form in individuals of the same species. Occasionally, however, aberrant examples occur, possibly due to injury, and two of these are figured herewith (Pl. XXIX, Fig. 11, and Pl. XXXVIII, Fig. 10).

Key to Pupæ*

1. Thoracic respiratory organs ending in numerous hairlike filaments (*Chironomus*) 2
— Thoracic respiratory organs simple, the surfaces usually covered with microscopic setulæ, or these organs entirely absent 20
2. Dorsal abdominal segments with flattened macelike appendage on middle of posterior margin ..... *Chironomus lobiferus* (p. 431).
— Dorsal abdominal segments without this appendage 3
3. Very large species, 13 mm. or more in length ..... { *Chironomus ferrugineovittatus* (p. 446). *Chironomus tentans* ..... (p. 445). *Chironomus plumosus* ..... (p. 447).
— Much smaller species, not more than 10 mm. in length 4
4. Dorsal abdominal segments with two large approximated, pear-shaped patches of setulæ (Pl. XXXIX, Fig. 9) 5
— Dorsal abdominal segments without such patches, the surface almost entirely covered with small setulæ 8
5. Apex of lateral margin of eighth abdominal segment without teeth or projections ..... *Chironomus tenuicaudatus?* (p. 475).
— Apex of lateral margin of eighth abdominal segment with distinct teeth 6
6. The apical teeth projecting laterad ..... *Chironomus dux.*
— The apical teeth projecting caudad 7
7. The apical lateral margin with a single strong, curved tooth ..... *Chironomus indistinctus* (p. 477).
8. Apical lateral angle of eighth abdominal segment with one or two large and strong spurs, or a distinct spur on lateral margin before apex *(C. fulvus?)* 9
— Apical lateral angle of eighth abdominal segment with either a large broad process the surface of which has many distinct spines, or with an apical comb of small spines or unspined 11
9. Dorsal abdominal segments with a few long hairs ..... *Chironomus fulvus?* (p. 478).
— Dorsal abdominal segments with minute setæ 10
10. Thorn at apex of lateral margin of eighth abdominal segment simple ..... *Chironomus tenellus.*
— Thorn at apex of lateral margin of eighth abdominal segment bifid ..... *Chironomus* sp. A (p. 529).
11. Dorsal abdominal segments without distinct transverse bands of setulæ† ..... *Chironomus decorus* (p. 473).

*Species without page number are not treated in text.

†Under this heading will come a number of closely allied species, including *cristatus, viridicollis*, and several others, the paucity of my material preventing me from arriving at a decision as to characters of use in their separation.

— Dorsal abdominal segments with distinct transverse bands on some of the segments in addition to the normal apical one on second segment 12

12. Eighth segment without lateral apical process; all segments finely honeycombed. (See Pl. XXI, Fig. 15, *a*) 13

— Eighth segment with distinct lateral apical process; segments not honeycombed 14

13. Head with 2 short conical tubercles. *Chironomus digitatus* (p. 483).

— Head with long, apically bifid processes (Pl. XXXVIII, Fig. 13) .. .. *Chironomus* sp. C (p. 530).

14. Segments 2–6 with distinct transverse band of setulæ near base, the remainder of disc with short setulæ which are scarcely stronger posteriorly ..... *Chironomus palliatus* (p .442).

— Segments 2–6 with 2 transverse bands of setulæ, one near base and the other near apex 15

15. Lateral apical process of eighth segment with 3 distinct spines... ..... *Chironomus fulviventris.*

— Lateral apical process of eighth segment with more than 3 distinct spines 16

16. Apical lateral angle of eighth segment with a transverse comb of rather short spines 17

— Apical lateral angle of eighth segment produced into a spurlike process which has many small spines 18

17. Anterior band on segments 2–6 narrow and distinct, posterior one also narrow but less distinct than anterior one..... ..... *Chironomus viridis* (p. 449).

— Anterior band on segments 2 and 3 broad, the setulæ much reduced in size towards posterior margin of band, the band on segment 4 also broad and conspicuous, tapering laterally, the setulæ much reduced in size and very densely packed together posteriorly, segments 5 and 6 without a distinct band, the setulæ on a large rounded area from near base to beyond middle elongated and very closely placed, tapering off in size posteriorly; segments 3 and 4 with narrow band of rather weak setulæ near posterior margin; disc of segments 2–6 and anterior portions of 7 and 8 with weak setulæ ..... *Pseudochironomus richardsoni** (p. 500).

18. Small species, 3.5 to 4 mm. in length. *Chironomus flavus* (p. 474).

— Larger species, over 6 mm. in length 19

19. Abdominal segments 2–6 each with 3 broad transverse bands of setulæ, the median one broad, enclosing numerous small rounded bare areas, the anterior and posterior bands narrow; discal hairs inconspicuous ..... *Chironomus flavicingula* (p. 432).

*The thoracic respiratory organs are not distinguishable in my specimens. Assuming that they are simple in structure, or even absent, the species will run down to No. 30 in this key, when the descriptions in text will serve to separate the species.

— Abdominal segments 2–6 with two narrow bands of conspicuous black setulæ which are not distinctly separated from the other discal setulæ, the anterior band consisting of only 2 or 3 rows of setulæ; median area of segments covered with short setulæ except on several small round patches; each segment with about 10 rather noticeable long hairs near margins..... .....*Chironomus nigricans* (p. 434).

20. Apical abdominal appendages with long, regular fringe; dorsal abdominal segments usually with conspicuous spotlike groups of setulæ on disc *(Tanytarsus)*.....21

— Apical abdominal appendages with either a few very long and conspicuous hairs or bare; or abdominal segments without spotlike groups of setulæ 26

21. Lateral margin of eighth abdominal segment with a simple apical spur .....*Tanytarsus exiguus* (p. 495).

— Lateral margin of eighth abdominal segment with several spines at apex 22

22. Fourth dorsal abdominal segment with a single patch of black spines near base; no other strong setæ present.....23

— Fourth dorsal abdominal segment with 2 anterior patches and other conspicuous setulæ 24

23. Third abdominal segment with patch of black spines near base..... .....*Tanytarsus* sp. A (p. 530).

— Third abdominal segment without patch of spines near base..... .....*Tanytarsus* sp. B (p. 530).

24. Fourth abdominal segment with two patches of black spines near base and a few scattered setæ on surface..... .....*Tanytarsus dives* (p. 488).

— Fourth abdominal segment with two longitudinal series of black setæ extending caudad of the patch near base.....25

25. Third abdominal segment with two transverse patches of black spines near posterior margin, which are almost connected at middle of segment.....*Tanytarsus dissimilis.*

— Third abdominal segments with two isolated, rounded patches of black spines near posterior margin..... .....*Tanytarsus dissimilis* "var. *a*" (Johannsen).

26. Thoracic respiratory organs indistinguishable.....27

— Thoracic respiratory organs distinct.....29

27. Abdominal dorsal segments 2–8 with posterior margins armed with a transverse series of closely placed teeth, and a large patch of smaller setulæ occupying an area from base to beyond middle, extending well towards lateral margins near base and tapering to a point on median line posteriorly .....*Metriocnemus knabi.*

— Abdominal segments with or without posterior transverse row of teeth but without conspicuous dorsal basal patch.....28

28. Abdominal dorsal segments 2–8 with the posterior margins armed with 10 to 12 short, stout, caudad-projecting teeth; ventral segments 3–8 with a similar series of 6 to 8 ..... *Diamesa waltlii* (p. 410).
— Abdominal dorsal segments each with a transverse band of stout black bristles, each band consisting of about 5 or 6 rows, located near posterior margins ..... *Thalassomyia obscura.*
29. Abdominal segments each with a conspicuous band of strong spines on their posterior margins 30
— Abdominal segments, with the exception of second, with at most weak setulæ on posterior margins 31
30. Apical abdominal appendages each with 3 long and conspicuous apical hairs; thoracic respiratory organ thickest beyond middle .. .. *Metriocnemus lundbecki* (p. 498).
— Apical abdominal appendages each with two short and inconspicuous hairs before apex ..... *Orthocladius flavus.*
31. Abdominal segments, except second, with dorsum nearly uniformly covered with short setulæ 32
— Abdominal segments with setulæ on dorsum arranged in transverse bands of various widths 34
32. Apex of eighth abdominal segment without long hairs laterally .. 33
— Apex of eighth abdominal segment with two long hairs laterally (Pl. XXXVIII, Fig. 4) .. *Orthocladius nivoriundus*, var.? (p. —).
33. Seventh and eighth abdominal segments each with 4–5 long strap-like hairs on lateral margins (Pl. XXXVIII, Fig. 5) .... *Orthocladius nivoriundus** (p. 525).
— Seventh and eighth abdominal segments each with 1–2 weak rounded hairs on lateral margins ... *Orthocladius* sp. D (p. 531).
34. Thoracic respiratory organs thickest at base, tapering to apex; third abdominal segment with the anterior half almost entirely covered with weak setulæ, the apical half with two bands of rather stronger setulæ, the preapical band broadest .... *Cricotopus trifasciatus* (p. 504).
— Thoracic respiratory organs not thickest, at base; third abdominal segment with a distinct and rather narrow transverse band of setulæ near middle 35
35. The band near middle consisting of two irregular rows of short stout spines ..... *Orthocladius sordidellus*†.
— The band near middle consisting of more than two rows of short weak setulæ 36

*Johannsen has very briefly described the pupa of *Cricotopus varipes*. Apart from the colors, which are black and yellow in *varipes* and fuscous in *nivoriundus*, there are no distinctions mentioned.

†Johannsen subsequently indicated that his identification of this European species was erroneous.

36. Small species, 2 mm. in length; colors (of enclosed imago) black and yellow ..... *Cricotopus exilis**.
— Larger species, 2.5–3 mm. in length; color (of enclosed imago) fuscous green ..... *Orthocladius fugax**.

Diamesa Meigen

This genus may be distinguished from any other in *Chironominæ* by the presence of the medio-cubital cross vein of the wing. From the genera in *Tanypinæ* it may be distinguished by the 8-jointed antennæ of the female and also by the distinctly chironomine type of larva.

One species has been found in Illinois, descriptions of all stages of which are given herewith.

Diamesa waltlii Meigen

Diamesa waltlii Meigen, Syst. Beschr. Eur. Zwiefl. Ins., Vol. 7, 1838, p. 13, sp. 1.

Larva.—Length, 8–10 mm. Pale green. Head brownish on posterior margins and apices of mandibles. Mandibles with five teeth; labium as in Figure 3, Plate XXIX, its apex very slightly darkened. Thoracic and anal pseudopods present, the former with apical hairs, the latter with distinct claws as in *Chironomus;* dorsal blood-gills four in number; anal blood-gills absent.

Pupa.—Length, 7–8 mm. Dark brown. Thoracic respiratory organs very small. Segments 2–7 of abdomen with a transverse row of about twelve small toothlike setulæ on the posterior margin; apex of abdomen with six distinct straplike filaments.

Imago; Male.—Black, slightly shining. Head and its members black; antennal plumes dark brown. Thorax with distinct gray pruinescence, which is most conspicuous beween the vittæ on mesonotum. Abdomen with posterior margins of segments gray pruinescent. Legs entirely fuscous. Wings slightly grayish, veins dark brown. Halteres yellow.

Palpi long, 5-jointed, the basal joint, as usual, very short, the next shorter than the third and fourth, apical joint longest. Hairs on mesonotum confined to the areas between the vittæ; scutellum rather densely haired; pronotum broad, continued almost to upper margin of mesonotum, a distinct notch in its center. Hypopygium as in Figure 11, Plate XXIII. Legs slender; fore tibia one and a half times as long as basal joint of fore tarsus; fourth tarsal joint of all legs

*I can find no structural characters mentioned in Johannsen's descriptions of *C. exilis* and *O. fugax* by means of which the species may be separated.

shorter than fifth; empodium as long as claws; claws simple. Wing venation as in Figure 1, Plate XXXV.

Female.—Agrees with the male in color, leg characters, and venation. Differs in having the antenna 8-jointed and short-haired.

Length, 3.5–5.5 mm.

Illinois localities: Illinois River at various points near Havana—larvæ common; Urbana, April 2, 1889 (John Marten), imago (male)—the only adult I have seen from this state.

Originally described from Europe and since recorded from New York, Idaho, Washington State, and Greenland. I have seen specimens from Plummer's Island, Md., April 28, 1907; from Denver, Colo., December 27, 1909, and from Montana. The last-mentioned specimens were taken by Dr. C. C. Adams at the snow-line on the mountains, where the females were ovipositing in the pools formed close to the melting snow. Johannsen records the larvæ as occurring "among the algæ on the surface of rocks over which the water flows rapidly." The larvæ in the collection here were taken when dredging in the Illinois River.

Thalassomyia Schiner

This genus is separable from *Orthocladius* by the structure of the tarsi, the fourth joint being distinctly shorter than the fifth and obcordate. The type species of the genus, *frauenfeldi* Schiner, has been found by Swainson "on Obelia zoophytes growing at the end of St. Anne's pier." This record refers to the occurrence in sea water."* Johannsen describes the larva, pupa, and imago of *T. obscura* from Ithaca, N. Y.

Thalassomyia obscura Johannsen

Thalassomyia obscura Johannsen, Bull. 68, N. Y. State Mus., 1903, p. 437.

Female.—Black, opaque. Head black, face and scape of antennæ yellow. Thorax black on disc, pronotum and a large spot on each anterior lateral angle yellow, the spaces between vittæ paler than vittæ, pleuræ mostly yellow, sternopleura and some smaller spots above it brownish; scutellum brown. Basal two segments of abdomen yellow, the others with indistinct pale posterior margins; venter yellow, infuscated at apex. Legs black, fore coxæ and trochanters and bases of femora of all legs yellow. Wings clear, veins brown. Halteres yellow.

*"An Account of British Flies," by Theobald, p. 202. 1892.

Antennæ with 8 joints, the constriction between the joints not deep. Pronotum continued rather broadly almost to the level of the mesonotum, central division rather wedge shaped; pruinescence on mesonotum white and conspicuous, especially on anterior lateral angles; surface hairs sparse; scutellum convex. Fore tarsus with basal joint about two thirds as long as tibia. Cubitus forking below cross vein.

Length, 3–4.5 mm.

Illinois locality, Momence, July 17, 1914, at light (C. A. Hart).

I have not seen the male, which is described by Johannsen. Two females sent me by him, labeled Ithaca, N. Y., agree with the female described here except that the colors are less sharply contrasted and the basal joint of the fore tarsus is rather more than two thirds the length of the tibia.

I have some doubt as to specific distinction between *obscura* and *platypus* Coquillett, but only an examination of the type of the latter could satisfactorily settle the point.

Thalassomyia fulva Johannsen

Thalassomyia fulva Johannsen, Bull. 124, N. Y. State Mus., 1908, p. 275.

Female.—Yellow, slightly shining. Head yellow; last joint of antennæ and palpi fuscous. Mesonotum with three reddish vittæ; pleuræ slightly reddish; posterior half of postnotum brownish. Legs yellow, apices of tarsi slightly infuscated. Wings clear, veins yellow. Halteres yellow.

Antenna short, basal 2 joints of flagellum with slight constriction between them, the others distinctly moniliform. Pronotum broad, the central emargination broad and shallow; no pruinescence and very few hairs on mesonotum. Legs slender but not very long; basal joint of fore tarsus slightly more than half as long as tibia (24:40); fourth tarsal joint very distinctly shorter than fifth but not obcordate. Cubitus forking almost directly below cross vein.

Length, 2.5 mm.

Illinois locality, Dubois, April 24, 1914. Swept from vegetation on bank of creek (J. R. Malloch).

Johannsen described *fulva* from Old Forge, N. Y. I have a slight doubt as to the generic position of this species since the fourth tarsal joint, though shorter than the fifth, is not obcordate. In other respects the species closely resembles *obscura* structurally.

The early stages are undescribed.

Corynoneura Winnertz

This genus of very small species is distinguished in the females from other genera of the *Chironominæ* by the absence of the anal angle of the wing and the peculiar thickening of the veins and membrane of the wing from the apex of the subcostal vein to the apex of the third. The antennæ of the male are 13-jointed, the flagellum short-haired and consisting of 11 joints; the antennæ of the female, 7-jointed.

Thienemanniella Kieffer differs from *Corynoneura* in having the eyes pubescent.

Corynoneura celeripes Winnertz

Corynoneura celeripes Winnertz, Stett. Ent. Zeit., Vol. 13, 1852, p. 50, sp. 3. Female.

Corynoneura atra Winnertz, ibid., sp. 4. Male.

This species is the only member of the genus recorded from North America. The sexes differ considerably in color, the male being much darker than the female, the mesonotum being velvety black, while the female has the thorax almost entirely yellow, with three brown or blackish vittæ on the mesonotum and the scutellum brown. Winnertz, misled by this color difference, described the sexes as different species.

Length (of both sexes) generally slightly less than 1 mm.

Illinois localities: Havana, April 29, 1914 (J. R. Malloch), and Algonquin, May 12, 1896 (W. A. Nason).

Originally described from Europe. Recorded subsequently from Greenland by Lundbeck, and from Ithaca, N. Y., by Johannsen. I have seen a female specimen taken at Lafayette, Ind., April 24, 1914, by Professor Aldrich.

Corynoneura similis, n. sp.

Female.—Yellow, opaque. Mesonotum with the vittæ dark brown; postnotum paler brown. Dorsal surface of abdominal segments brown, with pale spots at the bases of the hairs. Legs yellow. Wings clear, the thickened portions of the veins yellowish brown. Halteres yellow, knob pale brown.

Structurally very similar to *celeripes,* the most noticeable difference being in the wing venation. In *celeripes* the cubitus forks very distinctly beyond the apex of the third vein, whereas in *similis* it forks appreciably before that point. The thickening of the veins is also more abrupt in *celeripes* than in *similis.* The wing of the latter is

figured on Plate XXXV, Figure 10. The eyes are pubescent, a character which places this species in the subgenus *Thienemanniella* Kieffer.

Type locality, Havana, Ill., April 29, 1914 (J. R. Malloch). Paratypes from Urbana, Ill., May 25, 1914, at light (J. R. Malloch), and from Brownsville, Tex., November 18, 1911 (C. A. Hart).

I have made a balsam mount of a male which I consider belongs to *similis* and find that it differs from the female in having 13 antennal joints—not 11 as given by Kieffer.

In color the specimen differs from the female in being much darker, the thorax having black vittæ and the abdomen being almost entirely black, with yellow hypopygium. The legs are yellow. The wing veins are colorless.

The eyes are more distinctly pubescent than in the female. The second joint of the palpi is produced apically on one side, the third having the appearance of being inserted considerably before the apex of second. The third vein is continued beyond the middle of the wing, and the stigma-like swelling is absent.

Length, 1.25 mm.

Locality, Havana, Ill., April 30, 1914 (J. R. Malloch).

Chironomus Meigen

I have not adopted Kieffer's subdivisions of the genus *Chironomus* in the present paper, but retain in the genus all those species that have the wings bare and the basal joint of the fore tarsi longer than or subequal to the fore tibiæ. The only exception to the rule is in the case of *pseudoviridis*, which has the basal joint of the fore tarsi shorter than the fore tibiæ. This species and *æqualis* have the third vein ending distinctly farther in front of the wing-apex than the fourth does behind it—a character which seems to indicate an affinity with species of *Orthocladius*. I hope at some future time to revise the genera of North American *Chironominæ*—my present material is wholly insufficient for the task—but for the purpose of this paper I consider the present generic arrangement the most useful, and less likely to create disorder than that of Kieffer. Were I to introduce his generic names I could, from the printed descriptions of the species alone, assign but a few of them to their respective positions in his scheme of arrangement, and must leave a very large proportion of the species in the genus *Chironomus* with a doubt. Until some one obtains most of our species for study I consider it better to leave matters as they are.

The larvæ of the species of *Chironomus* present a great diversity of structure, and, as far as I am aware, possess no characters by which they may be readily separated generically from other *Chironominæ*. Ventral blood-gills on the eleventh segment can not be used even as a subgeneric character, since *ferrugineovittatus* and *plumosus*, which have almost identical imagines, represent both types of larvæ, the latter possessing and the former lacking ventral blood-gills. I have little hope that a better knowledge of the larval forms of this genus will enable us to separate them into subgenera in agreement with the subgeneric divisions proposed for the imagines by Kieffer. Biological data are given in notes on *viridicollis*, species 39.

The pupæ of such species as are known to me have the thoracic respiratory organs ending in many threadlike filaments, and the apical abdominal appendages usually broad, rounded apically, and fringed with numerous flattened hairs.

I have figured the hypopygia of many species of *Chironomus* in order to give an indication of the great variation in structure that exists within the genus. Sometimes, as in the case of *modestus* and *tenuicaudatus*, species of very similar appearance have very different hypopygia, while in other cases species with a very different general appearance have hypopygia of very similar structure.

With the exception of *flavicingula*, the description of which is unmistakable, none of Walker's species have been identified by the writer. Coquillett has recorded some of these species, and Johannsen besides accepting these has recorded the occurrence of some others. In view of the extreme brevity of Walker's descriptions and his use of color characters alone, I consider it unwise to adopt the hazardous course of the writers mentioned, and prefer, like Verrall, in his list of British species, to consider Walker's species as "unrecognizable" in their present condition. Many of Walker's types are lost, some of them probably destroyed, and in such cases the very inadequate descriptions of the species should be entirely disregarded.

The key given herewith is, for convenience, divided into "groups". These are largely artificial, and are not in any way intended to indicate a generic or subgeneric division of the species.

I have included in the key those species that are recorded from Illinois or represented in the collection of the State Laboratory of Natural History.

Key to Species

GROUP A

Species with wings spotted or banded

1. Mesonotum glossy black, sometimes slightly brownish; fore tibiæ blackish brown; fore tarsi blackened from base of apical third of basal joint to apex of tarsi; wings with an ill-defined dark central blotch (Pl. XXXV, Fig. 2) ..... 1. *brachialis.*
— Mesonotum and fore legs not colored as above; wing-markings either in the form of spots or bands which are well defined 2
2. Wings each with about 11 dark spots located between the veins .... 2. *varipennis.*
— Wings either banded or with 3 or 4 dark spots 3
3. Wings each with 4 dark spots, one at cross vein, one at middle of second posterior cell, one on posterior branch of cubitus, and one in anal cell ..... 3. *octopunctatus.*
— Wings either with 3 spots—none in second posterior cell—or with distinct fasciæ 4
4. Wings with 3 dark spots, 2 beyond the cross vein (one in the second posterior cell and the other in the fourth), and one in the anal cell, which is sometimes indistinct 5
— Wings with at least one complete fascia 6
5. Halteres yellow; spot in second posterior cell distinctly separated from cross vein; spot in anal cell distinct (Pl. XXXV, Fig. 3) .. .. 4. *needhami.*
— Halteres blackened apically; spot in second posterior cell touching the veins forming base of cell; all the spots very pale, the one in anal cell indistinct ..... 5. *griseopunctatus.*
6. Wings with the markings deep black, forming 2 broad fasciæ, the outer one before apex of wing and enclosing 2 small clear spots (Pl. XXXV, Fig. 4); apical third of fore femora thickened, black, densely black-haired on blackened portion; basal three-fifths of fore tibiæ snow-white, apical two-fifths black, fore tarsi white, a black band over bases and apices of basal 3 joints, apical 2 joints entirely blackened; basal joint twice as long as fore tibiæ ..... 6. *perpulcher.*
— Wing-markings grayish, outer fascia occupying apex of wing, with out clear spots; legs without sharply contrasted colors, generally yellow with brownish markings 7
7. Fascia at apex of wing faint and very narrow, the one at middle very broad, extending as far beyond cross vein as the distance from its outer margin, in second posterior cell, to apex of wing... ..... 7. *pulchripennis.*
— Fascia at apex of wing broader than the one at middle 8

8. Fore femora mostly brown, fore and hind tibiæ entirely so (female) or brown at bases and apices (male) ..... 8. *nephopterus.*
— Fore femora at apices, fore and hind tibiæ at bases, and the latter at apices brown ..... 9. *tæniapennis.*

GROUP B

Wings without spots or bands, at most with the cross vein infuscated

Section I

Abdominal segments in both sexes with depression on dorsal surface

The only species in this section has a distinct depression on basal half of dorsal segments 2 to 7 in both sexes which is slightly dilated posteriorly except on 6 and 7, where it is more elongated and parallel-sided ..... 10. *lobiferus.*

Section II

Abdominal segments without dorsal depression

Subsection 1

Fore tarsi with the basal joint not more than 1.5 as long as fore tibiæ

1. Femora dark brown, the mid and hind pairs each with preapical yellow band 2
— Femora either unicolorous black, yellow, or yellow with apices darkened, never with pale preapical band 3
2. Fore femora with preapical yellow band; hind tibiæ with central brown band in addition to the brown on bases and apices; male fore tarsi with long hairs, the basal joint slightly longer than fore tibiæ ..... 11. *flavicingula.*
— Fore femora without preapical yellow band; hind tibiæ without central brown band; male fore tarsi without long hairs, basal joint more than a third longer than fore tibiæ ..... 12. *devinctus.*
3. Black species; thorax entirely black or blackish brown, with or without distinct shining vittæ; abdomen rarely yellow 4
— Thorax with the ground color yellow or green; abdomen variable in color but never entirely black 27
4. Males 5
— Females 17
5. Thorax deep black; at least the basal half of abdomen pale green or whitish 6

— Thorax deep black, not contrasting sharply with base of abdomen, the latter with the segments at least partly black or brown.....8
6. Legs yellow, without black markings; fore tarsi with long hairs, basal joint about a fifth longer than fore tibiæ.....13. *nigricans.*
— Legs whitish, fore femora, except the bases and apices, black; fore tarsi without long hairs.....7
7. Basal joint of fore tarsi rarely 1.5 times as long as fore tibiæ (57 : 38) ; fore and mid coxæ and basal two-thirds of fore femora black, remainder of legs whitish yellow.....14. *fallax.*
— Basal joint of fore tarsi about one fifth longer than fore tibiæ (78 : 66) ; mid and hind coxæ browned, apical half of fore femora, the extreme apices of mid and hind femora, bases and apices of all tibiæ, and apices of tarsal joints blackened, remainder of legs whitish yellow .....15. *pedellus.*
8. Fore tarsi with long hairs on their posterior surfaces, the length of which greatly exceeds the diameter of the joints which bear them 9
— Fore tarsi without long hairs.....13
9. Basal joint of fore tarsi not more than a sixth longer than fore tibiæ 10
— Basal joint of fore tarsi at least a fourth longer than fore tibiæ..12
10. Second joint of fore tarsi shorter than third.....16. *barbipes.*
— Second joint of fore tarsi longer than third.....11
11. Legs yellow; basal joint of fore tarsi very slightly longer than fore tibiæ (75:70) ; hypopygium similar to that of *decorus* (Pl. XXXIII, Fig. 11).....17. *quadripunctatus.*
— Legs fuscous; basal joint of fore tarsi about a seventh longer than fore tibiæ (80:70) ; hypopygium as in Figure 6, Plate XXXVIII .....18. *utahensis.*
12. Basal joint of fore tarsi more than a third longer than fore tibiæ (92:68) ; large species, average length 7.5 mm.; hypopygium as in *decorus* (Pl. XXXIII, Fig. 11).....19. *fasciventris.*
— Basal joint of fore tarsi a fourth longer than fore tibiæ (45:36) ; small species, average length 5 mm.; hypopygium as in Figure 4, Plate XXXVI .....20. *claripennis.*
13. Thorax glossy black or blackish brown, without or with only slight pruinescence between the vittæ.....14
— Thorax with dense pruinescence between the vittæ, sometimes the entire surface densely pruinescent, or mesonotum opaque.....15
14. Halteres black; basal joint of fore tarsi a fifth longer than fore tibiæ (24:20) ; hypopygium as in Figure 10, Plate XXXIII..... .....21. *nigrohalteralis.*
— Halteres yellow; basal joint of fore tarsi barely longer than fore tibiæ (24:23) ; hypopygium as in Figure 15, Plate XXXIII..... ..... 22. *subæqualis.*

15. Thorax and abdomen entirely black, the former covered with dense pruinescence; basal joint of fore tarsi slightly longer than fore tibiæ (50:45); hypopygium as in Figure 16, Plate XXXIII.....23. *basalis.*
— Thorax or abdomen with reddish or yellowish marks; basal joint of fore tarsi much longer than fore tibiæ.....16
16. Thorax with the central vitta and generally the anterior half of the lateral pair reddish, contrasting sharply with the velvety black ground-color of thorax; abdomen entirely velvety black.....24. *palliatus.*
— Thorax black, vittæ concolorous; abdomen with yellow post-marginal bands to segments.....25. *riparius.*
17. Legs except the coxæ entirely yellow, without any black markings except the usual black apical comb on mid and hind tibiæ.....18
— Legs not entirely yellow except the coxæ.....19
18. Thorax glossy black; mid and hind coxæ blackened; basal joint of fore tarsi one fifth longer than fore tibiæ (72:60)..13. *nigricans.*
— Thorax opaque black, whitish pruinescence between the vittæ; mid and hind coxæ slightly browned; basal joint of fore tarsi one fifth longer than fore tibiæ (75:60).....40. *dimorphus.*
19. Legs pale yellow, fore femora except the bases and apices black.....14. *fallax.*
— Legs with more than fore femora black or fuscous.....20
20. Second joint of fore tarsi shorter than third.....16. *barbipes.*
— Second joint of fore tarsi longer than third.....21
21. Thorax black; abdomen pale yellowish or greenish with the apical 3 segments black or brown.....15. *pedellus.*
— Thorax black; abdomen either entirely black or with pale posterior margins to the segments.....22
22. Abdomen without noticeable pale posterior margins to segments.23
— Abdomen with conspicuous pale posterior margins to segments..25
23. Thorax glossy black; halteres black; small species, 2 mm. in length.....21. *nigrohalteralis.*
— Thorax opaque black; halteres yellow; larger species, at least 3 mm. in length.....24
24. Thorax densely covered with gray pruinescence; legs black; abdomen subshining, black.....23. *basalis.*
— Thorax with slight whitish pruinescence; legs mostly pale yellow, femora and tibiæ usually slightly browned; abdomen opaque black.....24. *palliatus.*
25. Basal joint of fore tarsi one half longer than fore tibiæ.....25. *riparius.*
— Basal joint of fore tarsi less than one half longer than fore tibiæ.....26
26. Large species, 7 mm. in length, or more; basal joint of fore tarsi more than a third longer than fore tibiæ.....19. *fasciventris.*

— Smaller species, 5 mm. in length; basal joint of fore tarsi about a fourth longer than fore tibiæ.....20. *claripennis.*

27. Large species, considerably more than 9 mm. in length.....28
— Smaller species, at most 8 mm. in length.....30

28. Fore tarsi of male without long hairs; mesonotum opaque, pale green, with deep black vittæ in both sexes, their surfaces slightly shining; hypopygium stout (Pl. XXXIII, Fig. 1)....26. *tentans.*
— Fore tarsi of male with long hairs on posterior surface; mesonotum opaque yellowish green, with gray or ferruginous vittæ.....29

29. Mesonotum of male with ferruginous vittæ; hypopygium as in Figure 4, Plate XXXIII; fore legs of female with long hairs which exceed in length the diameter of the joints which bear them .....27. *ferrugineovittatus.*
— Mesonotum of both sexes with gray vittæ; apical portion of lateral arm of hypopygium as in Figure 17, Plate XXXIV; fore legs of female with the hairs shorter than the diameter of the joints which bear them.....28. *plumosus.*

30. Males 31
— Females 43

31. Fore tarsi with long hairs.....32
— Fore tarsi without long hairs.....37

32. Basal joint of fore tarsi not more than a tenth longer than fore tibiæ 33
— Basal joint of fore tarsi more than a tenth longer than fore tibiæ 34

33. Basal joint of fore tarsi slightly longer than fore tibiæ; third vein ending as far in front of apex of wing as fourth does behind it; hypopygium as in Figure 3, Plate XXXIII.....29. *viridis.*
— Basal joint of fore tarsi slightly shorter than fore tibiæ; third vein ending distinctly farther from apex of wing than fourth does; hypopygium as in Figure 2, Plate XXXIII....30. *pseudoviridis.*

34. Basal joint of fore tarsi at most slightly more than a third longer than fore tibiæ; hypopygium with superior and inferior processes well developed 36
— Basal joint of fore tarsi nearly one half longer than fore tibiæ; hypopygium with superior and inferior processes very short...35

35. Apices of fore tibiæ and of basal joint of fore tarsi narrowly browned; hypopygium as in Figure 18, Plate XXXIV.....
.....31. *abbreviatus.*
— Apices of fore tibiæ and of basal joint of fore tarsi conspicuously and broadly blackened; hypopygium as in Figure 6, Plate XXXIII .....32. *frequens.*

36. Basal joint of fore tarsi slightly more than a third longer than fore tibiæ (85:63); hypopygium identical with that of *ferrugineovittatus* (Pl. XXXIII, Fig. 4).....33. *stigmaterus.*

— Basal joint of fore tarsi slightly less than a fourth longer than fore tibiæ (98:80); hypopygium with lateral arms very stout (Pl. XXXIII, Fig. 13).....34. *crassicaudatus.*

37. Apices of femora and bases of tibiæ of all legs blackened.....38
— Apices of femora not blackened.....39

38. Pale yellowish green species; mesonotum with reddish yellow vittæ; postnotum almost black, very conspicuous; abdomen entirely pale green.....35. *pallidus.*
— Reddish yellow species; mesonotum with reddish vittæ; postnotum brown, not conspicuously darker than other parts of thorax; abdomen yellow on basal half, blackened on apical half.....36. *aberrans.*

39. Small species, about 2.5 mm. in length; third vein ending distinctly farther in front of apex of wing than fourth does behind it; hypopygium as in Figure 2, Plate XXXIV.....37. *nigrovittatus**.
— Larger species, more than 3.5 mm. in length; third vein ending as near to apex of wing as does fourth.....40

40. Mesonotum with glossy black or blackish brown vittæ; legs yellowish green, fore tibiæ, the entire fore tarsi, and the mid and hind tarsi with the exception of basal half of the first joint dark brown.....39. *viridicollis.*
— Mesonotum with opaque or subopaque reddish or yellowish vittæ; legs almost entirely yellow or with apices of tibiæ and of tarsal joints blackened.....41

41. Basal joint of fore tarsi about a fifth longer than fore tibiæ (60:50); hypopygium as in Figure 11, Plate XXXIV.....40. *dimorphus.*
— Basal joint of fore tarsi more than a third longer than fore tibiæ.....42

42. Green species; apices of tibiæ and of basal 2 tarsal joints and the whole of apical 3 tarsal joints blackened; proportions of basal joint of fore tarsi and fore tibiæ 50, 35; hypopygium as in Figure 9, Plate XXXIV.....41. *abortivus*†.
— Yellowish species with fuscous abdomen; legs entirely pale yellow; proportions of basal joint of fore tarsi and fore tibiæ, 65, 45; hypopygium as in Figure 1, Plate XXXVI.....42. *fusciventris.*

43. Third vein ends distinctly farther in front of apex of wing than fourth does behind it.....44
— Third vein ends about the same distance in front of apex of wing as fourth does behind it.....46

44. Basal joint of fore tarsi shorter than fore tibiæ...30. *pseudoviridis.*
— Basal joint of fore tarsi distinctly longer than fore tibiæ.....45

*The specimens which I describe as females of *nigrovittatus* have the basal joint of the fore tarsi 1.5 as long as the fore tibiæ, or rather more than that, and may not belong to that species, having been taken in a different locality.

†Cf. 59, *parvilamellatus.*

45. Basal joint of fore tarsi about 1.5 as long as fore tibiæ.....37. *nigrovittatus.*
— Basal joint of fore tarsi about 1.10 as long as fore tibiæ...38. *harti.*
46. Apices of femora and bases of tibiæ conspicuously blackened or browned 47
— Apices of at least mid and hind femora and bases of corresponding tibiæ yellow 48
47. Basal 2 segments of abdomen yellow, the others fuscous.....36. *aberrans.*
— Abdomen entirely yellowish or greenish.....35. *pallidus.*
48. Basal joint of fore tarsi about a sixth longer than fore tibiæ.....29. *viridis.*
— Basal joint of fore tarsi distinctly more than a third longer than fore tibiæ 49
49. Mesonotum with glossy black or blackish brown vittæ; fore tibiæ and tarsi brown.....39. *viridicollis.*
— Mesonotum with pale yellowish or reddish vittæ.....50
50. Fore legs yellow, apices of joints of tarsi brownish.....33. *stigmaterus.*
— Fore legs whitish green, apices of tibiæ, of basal 2 joints of tarsi, and the apical 3 joints of latter blackened.....51
51. The greater portion of apical half of fore tibiæ and the entire apical third of basal joint of fore tarsi blackened.....32. *frequens.*
— Apex of fore tibiæ with a narrow black ring; apical sixth of basal joint of fore tarsi blackened.....41. *abortivus.*

Subsection 2

Fore tarsi with basal joint distinctly more than 1.5 as long as fore tibiæ

1. Thorax and abdomen black, blackish gray, or brown, abdomen with or without pale posterior margins to segments.....2
— Thorax and abdomen green or yellow, the thorax with or without reddish or blackish vittæ.....10
2. Males 3
— Females 7
3. Fore tarsi without long hairs on their posterior surfaces; legs entirely yellow; mesonotum shining black.....4
— Fore tarsi with long hairs on their posterior surfaces; legs brownish or partly fuscous; mesonotum gray pruinescent.....6
4. Large species, more than 4 mm. in length; abdomen with pale posterior margins to segments.....43. *fuscicornis.*
— Small species, 2.5 mm. in length.....5
5. Abdomen entirely black; fore tibiæ yellow.....44. *halteralis.*
— Abdomen yellowish on basal 2 segments; fore tibiæ blackened.....45. *nitidellus.*

6. Wings vitreous, veins almost colorless; third and fourth veins distinctly divergent towards apices, the former ending appreciably farther in front of apex of wing than fourth does behind it (Pl. XXXIX Fig. 15) ..... 46. *griscus.*
— Wings slightly grayish, veins yellowish brown; third vein bent downward as it nears apex of wing, ending at about the same distance from apex of wing as fourth does ..... 47. *maturus.*
7. Large species, averaging more than 4 mm. in length; abdominal segments with pale posterior margins 9
— Small species, averaging 2.5 mm. in length 8
8. Abdomen entirely black, fore tibiæ yellow ..... 44. *halteralis.*
— Abdomen yellowish on basal 2 segments; fore tibiæ blackened ..... 45. *nitidellus.*
9. Thorax glossy black; halteres black apically ..... 43. *fuscicornis.*
— Thorax subopaque, distinctly gray pruineseent; halteres yellow ..... 47. *maturus.*
10. Mesonotum with reddish vittæ, a conspicuous black or brown mark on center of anterior half of median vitta 11
— Mesonotum with the median vitta unicolorous, black or reddish .. 12
11. Bright green species; the black mark on median vitta linear; lateral vittæ unicolorous reddish ..... 48. *festivus.*
— Reddish yellow species; the dark mark on median vitta in the form of a wedge, its apex directed caudad; lateral vittæ brown on outer margins, shading gradually into red on inner margins ..... 49. *dorneri.*
12. Males 13
— Females 28
13. Apices of abdominal segments narrowly black or brown 14
— Apices of abdominal segments not narrowly darkened 15
14. Large species, averaging 8 mm. in length; fore tarsi with very long hairs on posterior surface from middle of first to apex of fourth joint; hypopygium as in Figure 14, Plate XXXIII ... 48. *festivus.*
— Small species, not more than 3.5 mm. in length; hairs on fore tarsi rather short, those on third joint longest; hypopygium as in Figure 1, Plate XXXIV ..... 50. *illinoensis.*
15. Abdominal segments each with a brown fascia at middle, rarely reaching to base of segments; plumes of antennæ bicolored, forming a broad brown ring at bases and another, narrower one, beyond middle, the rings separated by a narrow whitish band, apical portion whitish; hypopygium as in Figure 11, Plate XXXIII .... 51. *decorus.*
— Abdomen without median fasciæ on segments; plumes of antennæ rarely forming colored annuli 16
16. Second joint of fore tarsi longer than fore tibiæ 17
— Second joint of fore tarsi shorter than fore tibiæ 18

17. Pale yellow species; legs entirely yellow; hypoygium with superior and inferior processes well developed (Pl. XXXIV, Fig. 14) .....52. *flavus.*
— Pale yellowish green species; fore tibiæ and tarsi and apices of mid and hind tarsi brownish; superior process not distinguishable, inferior process poorly developed (Pl. XL, Fig. 2) .....53. *curtilamellatus.*
18. Hypopygium very slender, with only one pair of processes in addition to the lateral arms, Figure 12, Plate XXXIII .....54. *tenuicaudatus.*
— Hypopygium not slender, usually with 2 pairs of processes in addition to the lateral arms, or if with only 1 pair, these are very short 19
19. Inferior hypopygial process fureate apically 20
— Inferior hypopygial process simple apically 22
20. Thorax brownish, opaque, covered with dense gray pruinescence, vittæ blackish; abdomen dark green or fuscous; hypopygium with the superior process dilated apically .....55. *neomodestus.*
— Thorax bright green or yellowish green, very slightly pruinescent, vittæ reddish 21
21. Hypopygium with the superior process much dilated apically, each branch of the inferior process terminating in a sharp point (Pl. XXXIV, Fig. 8) .....56. *modestus.*
— Hypopygium with the superior process not dilated apically, each branch of the inferior process terminating in a rounded point (Pl. XXXIV, Figs. 6, 7) .....57. *indistinctus.*
22. Hypopygium with superior and inferior processes very short 23
— Hypopygium with superior and inferior processes well developed 24
23. Yellow species, thoracic vittæ reddish, abdomen pale greenish, somewhat blackened apically, basal joint of fore tarsi about 1.75 times as long as fore tibiæ .....58. *fulvus.*
— Green species, thoracic vittæ dark brown, abdomen dark green, suffused with fuscous; basal joint of fore tarsi slightly more than 1.5 times as long as fore tibiæ .....59. *parvilamellatus.*
24. Bright green species, abdomen unicolorous green; hypopygium as in Figure 5, Plate XXXIV .....60. *obscuratus.*
— Yellow or yellowish green species; abdomen with brown bands on segments 25
25. Fore tarsi with long hairs; hypopygium as in Figure 1, Plate XL .....61. *incognitus.*
— Fore tarsi without long hairs 26
26. Small species, 3–4 mm. in length .....62. *similis**.
— Larger species, more than 5 mm. in length 27

*The male of this species is not known to the writer.

27. Basal joint of fore tarsi about one half longer than fore tibiæ.....
.....63. *cristatus.*
— Basal joint of fore tarsi about four fifths longer than fore tibiæ....
.....64. *serus.*
28. Basal joint of fore tarsi nearly twice as long as fore tibiæ (57 : 29 and 102 : 55) ; mesonotum opaque.....29
— Basal joint of fore tarsi at most 1.75 times as long as fore tibiæ; mesonotum generally distinctly shining.....30
29. Thorax pale green, vittæ reddish, the spaces between the latter densely covered with whitish pruinescence; abdomen entirely green; proportions of basal joint of fore tarsi and fore tibiæ, 57, 29 .....65. *alboviridis.*
— Thorax greenish yellow, vittæ deep brown, the spaces between the latter slightly pruinescent; abdomen brown, posterior margins of segments conspicuously yellow; proportions of basal joint of fore tarsi and fore tibiæ. 102, 55.....64. *serus.*
30. Second joint of fore tarsi longer than fore tibiæ.....31
— Second joint of fore tarsi not longer than fore tibiæ.....32
31. Pale yellow species; mesonotum not vittate.....52. *flavus.*
— Green or greenish yellow species; mesonotum with the lateral vittæ darker than median vitta.....50. *illinoensis.*
32. Cross vein of wing infuscated.....33
— Cross vein of wing not infuscated.....34
33. Cross vein very conspicuously infuscated; frontal tubercles distinct
.....51. *decorus.*
— Cross vein slightly infuscated; frontal tubercles indistinguishable
.....66. *digitatus.*
34. Abdomen brown, posterior margins of segments yellowish; mesonotum with opaque brown vittæ.....62. *similis.*
— Abdomen green or yellow; mesonotum with shining reddish or yellowish vittæ, or not vittate.....35
35. Deep yellow species; abdomen sometimes greenish.....58. *fulvus.*
— Green species; thorax sometimes yellowish; abdomen always green 36
36. Cubitus forking very distinctly beyond cross vein...60. *obscuratus.*
— Cubitus forking very slightly beyond cross vein.....
..... { 54. *tenuicaudatus.*
56. *modestus.*
57. *indistinctus.*

GROUP A

Species with wings spotted or banded

— 1. Chironomus brachialis Coquillett

Chironomus brachialis Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 607.

Male.—Head entirely yellow. Thorax glossy black, the areas between those generally occupied by the vittæ in other species usually brown, scutellum and lower portions of pleuræ sometimes brownish; postnotum black. Abdomen yellow, dorsum of second segment blackened, narrowly at base, the black becoming broader posteriorly and extending laterally in the form of a narrow postmarginal band, bases of all but the apical two segments narrowly black, the last two and the hypopygium entirely black. Legs yellow, fore legs from before apices of femora, with the exception of basal two-thirds of metatarsi, blackened, as also the extreme apices of femora, bases and apices of tibiæ, and apices of tarsal joints of other legs. Wings as in Figure 2, Plate XXXV. Halteres yellow. Antennal plumes yellow; all surface hairs on body and legs yellow.

Antennæ with basal joint globose, entire length not exceeding that of head and thorax together. Discal hairs on mesonotum soft and inconspicuous, those on scutellum rather numerous but soft. Hypopygium as in Figure 8, Plate XXXIII. Fore tibia subequal in length to fore femur; basal joint of fore tarsus about one and a third times as long as fore tibia, its apical half and the whole of second joint with long soft hairs on posterior surfaces; mid and hind legs with the surface hairs barely as long as diameter of joints on which they are situated.

Female.—Similar in coloration to the male except that the thorax is usually entirely black. The fore legs are entirely black with the exception of the basal four fifths of the femora.

Antenna not over half as long as head and thorax combined, the hairs as long as apical joint. Fore tarsus without the long hairs; surface hairs on legs much shorter than diameter of the joints which bear them.

Length, 5–6.5 mm.

Illinois locality, Havana, September. Three males and one female.

Originally described from Westville, N. J., and also recorded from Ithaca, N. Y. (Johannsen).

The early stages are undescribed.

2. Chironomus varipennis Coquillett

Chironomus varipennis Coquillett, Proc. U. S. Nat. Mus., Vol. 25, p. 94.

Male.—Opaque brownish black. Antennæ yellowish, plumes concolorous. Thorax with distinct silvery pruinescence except at bases of the discal hairs on mesonotum, on the anterior extremity of the submedian line, and on the lower portions of pleuræ. Abdomen blackish brown except a subtriangular patch on middle of posterior margin of each segment, which is paler and covered with silvery pruinescence. Legs brownish; femora with a yellowish ring near apices, and tibiæ at middle and bases of all tarsal joints except the last yellowish. Wings as in Figure 7, Plate XXXV. Halteres yellow.

Antenna longer than head and thorax together, the plumes long and carried well toward apex. Thoracic hairs not conspicuous. (Abdomen and legs broken.)

Female.—Slightly darker in color than the male, but similarly marked.

Antenna shorter than thorax to apex of scutellum, the surface hairs much longer than apical joint. Mesonotum with the surface hairs stronger than in male. Hairs on abdomen as long as the segments on which they are situated. Fore tarsus much elongated, the basal joint twice as long as the tibia; mid and hind legs with moderately long surface hairs.

Length, 2.5–3 mm.

Illinois locality, Urbana, May 6, 1890. One male and two females in an aquarium (C. A. Hart).

Originally described from Las Vegas Hot Springs, N. M.

Early stages undescribed.

3. Chironomus octopunctatus Loew

Chironomus octopunctatus Loew, Wien Ent. Monatschr., Vol. 5, 1861, p. 33.

This species is very closely allied to *griscopunctatus*, described on a later page. It is separable by the difference in the wing-markings. The spot in the middle of the second posterior cell is absent in *griscopunctatus,* while the large spot on posterior branch of cubitus in that species is very much reduced in *octopunctatus*, and the spot in the anal cell of the latter is as distinct as are the other spots.

Length, 1.5 mm.

Illinois locality, Urbana, October 5 and 9, 1914, at light (C. A. Hart and J. R. Malloch).

This species was originally described from Cuba by Loew. It has not subsequently been recorded as far as I am aware.

—— 4. Chironomus needhami Johannsen

Chironomus needhami Johannsen, Bull. 124, N. Y. State Mus., 1908, p. 278.
Chironomus scalænus Johannsen (*nec* Schrank), Bull. 86, N. Y. State Mus., 1905, p. 201.

This species bears a close resemblance to *scalænus* Schrank, but according to Johannsen's description differs particularly in the comparative proportions of the fore tibia and basal joint of fore tarsus. The European form is said to have the basal joint of the fore tarsi twice as long as the fore tibiæ, whereas *needhami* has it but one and three fourths as long. A female submitted as *needhami* by Professor Johannsen has, I find upon measurement under a high magnification, the proportions 25 : 13. The density of the color between the two spots beyond wing-middle is variable; in some speciments it is almost wanting, while in others it is very distinct, forming with the spots an almost complete fascia (Pl. XXXV, Fig. 3).

I have not seen any European examples of *scalænus*, and follow Johannsen as indicated above.

Illinois localities: Havana, April 23, 1896 (C. A. Hart); Urbana, July 21, 1890, at light in woods (Hart and Shiga); same locality, at lighted store windows, September 15 and October 6, 1914 (C. A. Hart and J. R. Malloch); Momence, July 17, 1914, at light (C. A. Hart); Monticello, June 28, 1914 (C. A. Hart and J. R. Malloch).

Originally described as *scalænus* by Johannsen from specimens obtained at Ithaca, N. Y., and from Washington State. Subsequently, records for Indiana and Kansas were added by Johannsen. The species recorded as *scalænus* from New Hampshire is very probably *needhami*. Mr. Hart took the species at light at Niles, Mich., July 13, 1914.

The early stages are undescribed.

5. Chironomus griseopunctatus, n. sp.

Female.—Brown, opaque. Head obscurely yellowish, antennæ brownish yellow. Mesonotum with three deep brown vittæ, the median one divided by a whitish gray pruinescent stripe, the spaces between the median and lateral vittæ similarly pruinescent; scutellum and postnotum brown. Abdomen almost black, with indistinct pale margins to segments or unicolorous. Legs yellow, coxæ, bases of femora, and apices of tarsi brownish. Wings clear, a pale gray spot

in base of second posterior cell, touching the cross vein and the posterior side of third vein, and carried as a more or less distinct suffusion into the third posterior cell; the spot in fork of cubitus carried over into anal cell in the area between the base and apex of posterior branch of cubitus; spot in anal cell almost indistinguishable. Halteres yellow, knob almost entirely blackened.

The basal joint of fore tarsi is twice as long as fore tibiæ (30 : 15). Otherwise as *needhami*.

Length, 1.5 mm.

Type locality, Momence, Ill., July 17, 1914, at light (C. A. Hart). Paratype from Plummer's Island, Md., August 17, 1912 (W. L. McAtee); in collection of the U. S. Bureau of Biological Survey.

6. Chironomus perpulcher Mitchell

Chironomus perpulcher Mitchell, Jour. N. Y. Ent. Soc., 1908, Vol. 16, p. 13.

This species is readily distinguished from any other described American species of this genus by the wing-markings (see Pl. XXXV, Fig. 4).

Illinois localities: Mt. Carmel, June 30, 1906, St. Joseph, June 9, 1912, and Monticello, June 21–30, 1914; Urbana, July 7, 1914 (C. A. Hart and J. R. Malloch).

Originally described from examples taken at Plummer's Island, Md., in August. I have seen specimens taken at Lafayette, Ind., in June and August (4th) by Professor Aldrich.

The early stages are undescribed.

— 7. Chironomus pulchripennis Coquillett

Chironomus pulchripennis Coquillett, Proc. U. S. Nat. Mus., 1902, Vol. 25, p. 94.

This species is very closely allied to *tæniapennis*, but the wing-markings serve to separate them most readily. (See Pl. XXXV, Fig. 5.) Johannsen says: "seems to be a synonym of *tæniapennis* Coq.," but I regard the species as distinct.

Represented in the collection here by a single female from Algonquin, August 31, 1894 (Nason).

Originally described from Franconia, N. H.

The early stages are undescribed.

8. Chironomus nephopterus Mitchell

Chironomus nephopterus Mitchell, Jour. N. Y. Ent. Soc. 1908, Vol. 16, p. 7.

The wing-markings of this species and those of *tæniapennis* are almost identical. The characters given in the synoptic key herewith

must be depended upon for the separation of the species, which are very closely allied.

Illinois localities: Urbana, August 17, 1892, at light; White Heath, May 18, 1889; Champaign, August 3, 1889, at electric light; Carbondale, April 23, 1914, swept from vegetation along side of stream; Muncie, July 5, and Monticello, June 21 and 28, all in 1914 (C. A. Hart and J. R. Malloch).

Originally described from specimens taken at Cabin John, Md., June 3. I have seen specimens from Polk County, Wis. (Baker), and Lafayette, Ind. (Aldrich).

Early stages undescribed.

— 9. Chironomus tæniapennis Coquillett

Chironomus tæniapennis Coquillett, Proc. U. S. Nat. Mus., 1901, Vol. 23, p. 607.

Wing-markings as in Figure 6, Plate XXXV. Palpus as in Figure 11, Plate XXXII.

There are two specimens in the collection here, which were taken at Algonquin, Ill., by Dr. W. A. Nason.

The type series came from Massachusetts and New Jersey, and the species has been recorded from Illinois, New York, South Dakota, and Pennsylvania.

Early stages undescribed.

GROUP B

Wings without spots or bands, at most with the cross vein infuscated

Section I

Abdominal segments in both sexes with depression on dorsal surface

10. Chironomus lobiferus Say

Chironomus lobiferus Say, Jour. Acad. Nat. Sci. Phil., Vol. 3, 1823, p. 12, sp. 1.
Chironomus lobifer Wiedemann, Aussereurop. Zweifl. Ins., Vol. 1, 1828, p. 16, sp. 14.

Larva.—Length, 13–15 mm. Red. Head brown, eye spots divided; labium as in Figures 7 and 8, Plate XXIX; mandibles normal in form. Dorsal blood-gills four in number, rather short, ventral blood-gills rudimentary, two in number, situated high on side of eleventh segment.

Pupa.—Length, 8–9 mm. Dark brown. Frons without tubercles. Thoracic respiratory organs hairlike, of the usual chironomid type. Second abdominal segment with the normal apical transverse series of setulæ, the other segments without distinct setulæ; segments 2–6 with a macelike flattened process lying close to dorsum, which apparently projects from the apex of the preceding segment and is armed apically with spines (see Pl. XXXI, Fig. 2); apical lateral comb of eighth segment very short, consisting of about seven teeth; apical appendage with the normal fringe.

Imago; Male.—Brownish black. Head and its members black, antennal plumes dark brown. Thorax covered with grayish pruinescence, the black vittæ less densely covered than the spaces between. Abdomen black, posterior half of each segment with a large gray pruinose spot on each side, the spots meeting in center posteriorly. Legs yellow, apices of femora and bases of tibiæ generally distinctly brownish, apices of tibiæ and of tarsal joints narrowly brown. Wings slightly grayish, veins brown, cross vein slightly infuscated. Halteres yellow.

Pronotum broad, nearly equal in width to apex when viewed from side, not extending to upper margin of mesonotum. Abdominal segments with bare depressions on the areas, corresponding to those of pupa, which underlie the macelike projections; segments 6 and 7 slightly broader and shorter than 5; hypopygium as in Figure 9, Plate XXXIII. Fore tarsus with long hairs on posterior surface from middle of basal joint, the latter more than one and a half times as long as fore tibia. Cubitus forking almost directly below cross vein.

Female.—Agrees with male in color, and in the structure of abdomen—aside from the genitalia. Fore tarsi without the long hairs.

Illinois localities: Havana and at various other points on the Illinois River as far north as Marseilles, above the dam—larvæ, pupæ, and imagines; Muncie, Champaign, Urbana, Dubois, East St. Louis, —on dates ranging from April 24 to September 6. Some specimens were taken at light.

Originally described by Say, who said in regard to its distribution: "Inhabits the United States." Johannsen records its occurrence at Albany, N. Y., in the larval stage, and described the dorsal abdominal appendages of the pupa, though he indicated that they were imaginal and not pupal. The same, as to description, is true of Say. My miscroscopic preparations prove that the appendages they described were pupal, as described herewith. I have before me examples of this species from Lake Delavan, Wis., and from Berrien Springs and Grand Junction, Mich., taken by Mr. Hart; and have seen examples from Plummer's Island, Md. (W. L. McAtee).

I have obtained from Mrs. A. T. Slosson the specimen upon which the recorded occurrence of *nivcipcnnis* Fabricius in this country is based, and find that it is a female of *lobifcrus*. Its locality is Charlotte Harbor, Fla.

Section II

Abdominal segments without dorsal depression

Subsection 1

Fore tarsi with the basal joint not more than 1.5 as long as fore tibiæ

11. Chironomus flavicingula Walker

Chironomus flavicingula Walker, List Dipt. Brit. Mus., Vol. 1, p. 20. 1848.

Larva.—Length, 11–12 mm. Blood-red. Head brown; antenna rather short, the apical process with five distinct joints instead of the normal four (Pl. XXX, Fig. 10); labium as in Figure 1, Plate XXIX. Ventral blood-gills present, both pairs well developed, the dorsal blood-gills large, nearly as long as the pseudopods.

Pupa.—Length, 8–9 mm. Reddish, becoming brown as it matures. Frontal tubercle as in Figure 1, Plate XXXI. Thoracic respiratory organs white, hairlike. Second abdominal segment with the normal apical transverse series of setulæ; segments 2–6 with three transverse patches of microscopic setulæ, a narrow one near base, a much broader one on middle, which contains a number of small rounded bare spots, and another much narrower one near apex (Pl. XXXI, Fig. 4); apical lateral process of eighth segment not elongated, armed apically with several short flat spines as in Figure 18; apical abdominal appendage normal.

Imago; Male.—Opaque brown-black. Head and its members black; antennal plumes brown. Thorax with grayish pruinescence, which is most distinct between the vittæ, the latter opaque black. Abdomen with very distinct white pruinescent hind margins to all except the apical two segments. Legs yellow, coxae and femora brown, the latter with a narrow yellow preapical band, tibiæ broadly brown at bases and narrowly so at apices, the hind pair with a median brown band; tarsi with the apices of the basal 3 joints, and the whole of the apical 2, brown. Wings clear, veins yellow, cross vein conspicuously infuscated.

Pronotum linear above, with a broad median division; mesonotum continued above pronotum. Seventh segment of abdomen not

longer than sixth; eighth transverse apically; hypopygium as in Figure 5, Plate XXXIII. Fore tarsus with long hairs on posterior surface from middle of basal joint to apex of fourth; basal joint barely appreciably longer than tibia. Cubitus forking below cross vein.

Female.—Color, and proportions of fore tibia and basal joint of fore tarsus as in male.

Length, 6.5–8 mm.

Illinois localities: Illinois River at Havana, larvæ and pupæ; Havana, East Peoria, Urbana, Normal, Algonquin, Dubois, and Parker, imagines. Dates of occurrence, in April, May, and August.

A male specimen was reared from a larva taken in Salt Fork at Homer Park March 21, 1914, by the writer. The adult emerged March 27, after passing three days in the pupal stage. The figures of larval and pupal details given herewith were drawn from the exuviæ of this specimen mounted in Canada balsam. There are slight discrepancies between these figures and those given by Johannsen for this species.

Walker's original specimens came from St. Martin's Falls, Albany River, and Hudson Bay. Johannsen records the species from Ithaca, N. Y., and from Kansas.

C. nævus Mitchell differs noticeably from *flavicingula* in having the wings each with five spots, one at the cross vein, one in middle of second posterior cell, one in middle of fourth posterior cell, and usually two in anal cell, the one nearest to anal angle rather indistinct. This species was described from Beulah, N. M., and taken at an altitude of 8000 feet. I have seen a specimen from Professor Aldrich, taken at Palo Alto, Calif.

12. Chironomus devinctus Say

Chironomus devinctus Say, Jour. Acad. Nat. Sci. Phil., Vol. 6, 1829, p. 150.
Chironomus compes Coquillett, Proc. Ent. Soc. Wash., Vol. 9, 1908, p. 145.

Male.—Differs from *flavicingula* in having the fore tarsi without long hairs, the basal joint much longer than the tibiæ (1.75 : 1.25), the hind tibiæ without the median brown band, and the cross vein of the wing clear.

Female.—Agrees with male in color and proportions of fore tibiæ and basal joint of fore tarsi.

Length, 6.5–8 mm.

Illinois localities: Quiver Lake (Illinois River) May 8, 1896, and Urbana, May 25, 1898 (C. A. Hart); Muncie, May 24, and Centerville, August 16, 1914 (J. R. Malloch).

Originally described from Indiana. Johannsen records it from Ithaca, N. Y., while Coquillett redescribed it from Plummer's Island, Md., from which locality I have seen a female in the collection of the U. S. Bureau of Biological Survey. I have also seen specimens taken by Professor Aldrich at Lafayette, Ind., on August 5 and October 2, 1913.

I suggested the above synonymy in my recent paper*, and believe that it is correct.

— 13. Chironomus nigricans Johannsen

Chironomus nigricans Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 219.

Larva.—Length, 11–12 mm. Blood-red. Antenna rather slender, about a fourth shorter than mandible, joint 2 as long as 3+4; labium with the median tooth divided and distinctly longer than the other teeth, first and fourth lateral teeth shorter than second and third. No ventral blood-gills, two dorsal pairs present.

Pupa.—Length, 5.5–6.5 mm. Pale brown. Segments 2–6 with a transverse band of short blackish setulæ near the anterior margin, the disc covered with shorter, paler setulæ enclosing numerous small rounded bare spaces, the setulæ becoming larger and darker posteriorly, forming a bandlike patch near posterior margin; second segment with the normal apical series of black setulæ; lateral apical process of eighth segment with several rather large teeth.

Imago; Male.—Head entirely fuscous. Thorax glossy black; pleuræ sometimes brownish; scutellum varying from yellow to brown. Abdomen greenish white, posterior margins of segments narrowly blackened; rarely the apical 2 or 3 segments slightly infuscated. Legs whitish or greenish. Wings clear, cross vein not infuscated. Halteres whitish or greenish.

Palpi of male as in Figure 8, Plate XXXII. Hypopygium very closely resembling that of *fallax*, the inferior process as in Figure 3, Plate XXXIV. Fore tarsi with long hairs; basal joint about one sixth longer than fore tibiæ (75:65). Third vein ends as far before apex of wing as fourth does behind it; cubitus forks almost directly below cross vein.

Female.—Glossy black or blackish brown. Antennæ pale yellow, basal and apical joints generally fuscous. Scutellum sometimes brownish yellow. Abdomen with narrow pale hind margins to dorsal and ventral segments or the former entirely dark. Legs whitish yellow. Halteres pale yellow.

Differs from the male in having the fore tarsi without long hairs.

*Bull. Ill. State Lab. Nat. Hist., Vol. 10, Art. 4, 1914, p. 214.

Length, 4.5–6 mm.

Illinois localities: Illinois River and connected waters at and near Havana, the imagines occurring in abundance on tree trunks and houses and flying near the river in late April and May; Carbondale, April 23, 1914 (C. A. Hart and J. R. Malloch).

Originally described from Ithaca, N. Y., from which locality I have had a specimen submitted by Professor Johannsen. The species is also recorded by him from New Jersey. I have examined specimens of this species belonging to the collection of the U. S. Bureau of Biological Survey which were taken by W. L. McAtee at Plummer's Island, Md., and Washington, D. C., in June, July, and August.

The record of *albipennis* Meigen for New Jersey is probably based upon a specimen of this species.

14. Chironomus fallax Johannsen

Chironomus fallax Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 210.

Male.—Glossy black. Head black; scape of antennæ brown, flagellum greenish; palpi greenish yellow. Thorax black, the spaces between the normal vittæ very faintly pruinescent; scutellum brownish. Abdomen whitish green, the apical two segments and base of hypopygium black, apical portion of lateral arms of hypopygium yellowish. Legs whitish yellow, fore coxæ and a broad median band on fore femora black. Wings clear, veins almost vitreous. Halteres whitish yellow. Plumes of antennæ and hairs on legs whitish yellow.

Pronotum very short, almost linear, not continued to upper margin of mesonotum; scutellum convex, rather longer than usual. Apical portion of lateral arm of hypopgium longer than basal (Pl. XXXIII, Fig. 7). Fore tarsi very slender, bare, basal joint more than one and a half times as long as fore tibia. Mid and hind legs with long hairs. Wing with third vein almost to apex; cubitus forking distinctly beyond cross vein, the latter slightly before wing-middle.

Female.—Differs from the male in having the head and its members yellowish, only the last joint of antennæ being black; the scutellum, basal segment of abdomen, and apices of remaining segments yellow.

Length, 3–4 mm.

Illinois localities: Monticello, June 28, Momence, July 14, at light, and Centerville, August 16, 1914 (C. A. Hart and J. R. Malloch).

Originally described from Ithaca, N. Y. I have seen two females from the type locality, kindly submitted by Professor Johannsen.

15. Chironomus pedellus DeGeer

Tipula pedellus DeGeer, Mém. pour serv. à l'Hist. d. Ins., Vol. 6, 1776, p. 378.
Chironomus pedellus (DeGeer) Meigen, Syst. Beschr. Eur. Zweifl. Ins., Vol. 1, 1818, p. 28, sp. 16.

Male.—Differs from *fallax* principally in the color of the legs, all of the femora, the tibiæ, and the tarsal joints being blackened at their apices, and the tibiæ at their bases also. In other respects similar in color to *fallax*.

The fore tarsi are without long hairs, the basal joint is about a fifth longer than the fore tibiæ (78:66), and the hypopygium is similar to that of *nigricans* except that the superior process is comparatively stouter and less distinctly curved.

Female.—Agrees with the male in coloration except that the thorax has the anterior angles yellowish.

Length, 5.5 mm.

Illinois locality, Algonquin, April 29, 1895 (W. A. Nason).

Originally described from Europe. Recorded from Wisconsin, New Jersey, and New York. I have seen a specimen from Lafayette, Ind., April 28, 1914 (J. M. Aldrich).

Except in color characters this species does not seem to be separable from *aberrans* Johannsen. There is, however, such a striking difference between the deep black thorax of *pedellus* and the yellow one of *aberrans* that I hesitate to suggest that they may be the same species.

16. Chironomus barbipes Staeger

Chironomus barbipes Staeger, Kröjer: Naturh, Tidskr., Vol. 2, 1839, p. 561.

Male.—"Hairy, blackish species with hyaline wings having the anterior veins somewhat reddish; halteres sordidly yellow, the extreme tips a little darker; the second joint of the fore tarsus a little shorter than the third. Length, 8 mm.

"Head and basal joint of antenna dull black, the flagellum of the latter and the palpi fuscous. Antennal hairs dark reddish brown. Thorax cinereous, with three faintly marked wide cinereous black stripes; scutellum, pectus, pleura and metanotum cinereous. Abdomen black, the posterior margins of the segments cinereous, covered with long brown erect hairs. Genitalia brown, the claspers rather short and stout, the dorsal keel of moderate size. The coxae cinereous; the legs testaceous, the bases of the femora, the knees, the tips of the tibiae, and the middle and hind tarsi a little darker, the fore tarsi except basal half of metatarsus brown and densely bearded with long brown hairs. The fore femora and tibiae and basal half of meta-

tarsi nearly bare; the whole of the middle and hind legs quite hairy. Fore metatarsus about one sixth longer than its tibia; the *second tarsal joint shorter than the third.* The wings narrow and long, hyaline with very slight yellow tinge; the costa, radius, R–M crossvein and the basal half of the media testaceous, the other veins hyaline; . . . . Halteres yellowish.

Female.—"Basal half of antennae yellowish, fore tarsi bare. Readily distinguished from related species by its short second tarsal joint."—*Johannsen.*

Illinois locality, Chicago, May, 1899.

The above description and record are from Johannsen's paper in Bulletin 86 of the New York State Museum, 1905, page 212.

I have not seen the species, which was originally described from Europe and has not been recorded from North America except by Johannsen.

Early stages undescribed.

17. Chironomus quadripunctatus, n. sp.

Male.—Reddish brown, slightly shining. Head, including the scape and basal flagellar joint of antennæ, reddish, the remainder of flagellum and the palpi fuscous. Vittæ very slightly darker than remainder of mesonotum; scutellum concolorous with mesonotum, pleuræ and postnotum brownish. Abdomen deep brown, the segments with narrow, posterior marginal pale bands. Legs and halteres yellow. Wings clear, veins pale yellow; cross vein not infuscated. Antennal plumes brown, body hairs yellow.

Frons without distinguishable tubercles; antepenultimate joint of palpi distinctly thicker than penultimate and slightly longer, ultimate joint slender and distinctly longer than penultimate (Pl. XXXII, Fig. 3). Mesonotum with but slight pruinescence on areas between the vittæ. Abdomen with four small, oval shining spotlike areas in a square near posterior margin on dorsal surfaces of segments 2–6; hypopygium much like that of *decorus,* the apical portion of lateral arm rather thick apically and about equal in length to basal portion. Fore tarsus with long hairs on posterior surface, basal joint barely longer than tibia (75 : 70). Cross vein slightly before wind-middle; cubitus forking at wing-middle.

Length, nearly 9 mm.

Type locality, Lake Delavan, Wis., September 7, 1892 (C. A. Hart).

Early stages unknown.

18. Chironomus utahensis, n. sp.

Male.—Black, slightly shining. Head entirely black, antennal plumes fuscous. Mesonotum with the spaces between the vittæ covered with grayish pruinescence; pleuræ and scutellum gray pruinescent. Abdomen with very slight pruinescence on the posterior margins of segments. Legs black, tibiæ and bases of tarsi brownish. Wings clear, first and third veins blackish brown, cross vein slightly infuscated, the other veins indistinct. Halteres black, the knobs yellow.

Frontal tubercles distinct; antepenultimate palpal joint longer than penultimate, the latter and the ultimate subequal. Pronotum distinct but not broad. Hypopygium as in Figure 6, Plate XXXVIII. Fore tarsi with long hairs, basal joint very little longer than fore tibiæ (83: 75); mid and hind legs with long hairs. Venation as in *maturus*.

Length, 7–8 mm.

Type locality, Kaysville, Utah, April 7, 1912 (E. R. Kaimbach).

This species is probably that which was considered as *niveipennis* by Johannsen. The latter species was recorded from Florida by Johnson, but the specimen upon which the record is based is a female of *C. lobiferus,* which I have before me.

The type specimen of *utahensis* is in the collection of the U. S. Bureau of Biological Survey.

Niveipennis Fabricius, or at least an Austrian specimen named as such, submitted by Professor Johannsen, has the extension of the dorsal plate of the hypopygium much longer than in *utahensis* and the whole hypopygium more slender.

19. Chironomus fasciventris, n. sp.

Male.—Black, slightly shining. Head brown, face yellowish; antennæ black, extreme base of flagellum brownish, the plumes brown. Thorax with yellowish gray pruinescence, the vittæ less densely covered than the remainder of disc, anterior lateral angles of mesonotum and scutellum sometimes yellowish. Abdomen with the apical third of segments 1–5 pale yellow, the remaining segments with less distinct yellowish marks on lateral apical angles. Legs brownish yellow, apices of femora, bases and apices of tibiæ, the apices of basal two tarsal joints and the apical three slightly darkened. Wings clear, veins yellowish, cross vein distinctly infuscated. Hairs on body and legs yellow. Halteres yellow.

Frontal tubercles distinct; antepenultimate joint of palpi slightly the longest. Pronotum moderately broad throughout its entire length.

Hypopygium similar to that of *decorus* (Pl. XXXIII, Fig. 11) except that the superior process is comparatively longer, more slender, and more distinctly curved, and the apical portion of the lateral arm is not constricted at apex. Fore tarsi with long hairs, basal joint about one third longer than fore tibiæ (92:68). Venation similar to that of *maturus*.

Female.—Agrees with the male in color. The basal joint of fore tarsus is slightly longer in comparison with the tibia than in the male, and the long tarsal hairs are absent. Otherwise as the male.

Length, 7–8 mm.

Type locality, Dubois, Ill., April 24, 1914 (C. A. Hart and J. R. Malloch). Several specimens taken at light; the others swept from vegetation on banks of streams.

This species differs from *hyperboreus* Staeger in having the abdomen with very conspicuous yellow bands and the legs yellowish instead of black.

20. Chironomus claripennis, n. sp.

Male.—Black, slightly shining. Head black, antennal plumes fuscous. Mesonotum slightly pruinescent, most distinctly on spaces between the vittæ; scutellum sometimes brownish. Abdomen black or blackish brown, hypopygium yellowish. Legs brown, tibiæ and basal half of tarsi yellowish. Wings clear, veins entirely yellowish. Halteres yellow, the knobs sometimes brownish. Hairs on body and legs yellowish.

Differs from the preceding species in being much shorter, 4.5–5 mm., in having the basal joint of the fore tarsi one fourth longer than the fore tibiæ (45:36), and the hypopygium much more slender, with the superior and inferior processes very short (Pl. XXXVI, Fig. 4).

Female.—Differs from the male in having the ground color of the thorax brownish yellow.

Length, 3.5–4 mm.

Type locality, South Haven, Mich., July 14–15, 1914 (C. A. Hart). One specimen taken at light; the others on shore of Lake Michigan.

A female taken at Grand Tower, Ill., April 21, 1914, on the bank of the Mississippi River by Mr. Hart and the writer differs from the type in having the halteres dark brown, the pale posterior margins of the abdominal segments very narrow, the last joint of fore tarsi shorter in comparison with the fourth (8:16 as against 7:11) and the cubitus forking more distinctly beyond the cross vein.

This specimen may represent a distinct species.

21. Chironomus nigrohalteralis, n. sp.

Male.—Black. Head black, antennal plumes fuscous. Thorax black, the disc glossy, with very slight pruinescence. Membranous area on pleuræ brownish. Abdomen entirely black, shining. Legs black, tibiæ and basal two or three tarsal joints, except their apices, yellowish brown. Wings clear, veins yellow, black at base of wing. Halteres black. Hairs of body blackish brown, those on legs paler.

Pronotum distinct nearly to upper margin of mesonotum, the latter with few hairs on disc. Hypopygium as in Figure 10, Plate XXXIII. Fore tarsi without long hairs, basal joint about a fifth longer than fore tibiæ (24 : 20) ; hairs on mid and hind legs inconspicuous. Third vein ends noticeably before wing-tip, similar to that of *pseudoviridis* (Pl. XXXIX, Fig. 1) ; cubitus forks appreciably beyond cross vein.

Female.—Agrees in color with the male, except that the wings are slightly grayish.

Length, 1.75–2.25 mm.

Type locality, Havana, Ill., April 28, 1914 (C. A. Hart and J. R. Malloch).

The early stages are unknown.

22. Chironomus subæqualis, n. sp.

Male.—Black, shining. Head black; antennæ with the flagellum and plumes fuscous. Thorax glossy black, without traces of pruinescence. Abdomen subshining black, segments without traces of pruinescence. Legs black, tibiæ and bases of tarsi fuscous. Wings slightly grayish, veins brown. Halteres white.

Pronotum linear, not extending to upper margin of mesonotum, which protrudes considerably anteriorly; disc of mesonotum with a few weak black hairs. Abdomen slender; penultimate and antepenultimate segments slightly broadened, the last segment narrowed; hypopygium as in Figure 15, Plate XXXIII. Legs slender; fore tarsi without long hairs, basal joint very slightly longer than tibia (27 : 25). Third vein ends at beginning of curve at apex of wing; the first ends before middle of third; second, distinctly separated from first, ending midway between apex of first and apex of third; cross vein at middle of wing; cubitus forking appreciably beyond cross vein.

Female.—Differs from the male in having the legs stronger and the basal joint of fore tarsi almost the same length as the fore tibiæ.

Length, 2–2.5 mm.

Type locality, Muncie, Ill., May 24, 1914 (C. A. Hart and J. R. Malloch).

The early stages are unknown.

This species has the usual comb of spinules at apex of hind tibiæ which characterizes *Chironomus*. In the *Orthocladius* group the hind tibiæ have one or two apical spurs.

23. Chironomus basalis, n. sp.

Male.—Black. Head entirely black, plumes of antennæ fuscous. Thorax opaque, entirely covered with dense grayish pruinescence; postnotum with the pruinescence more dense on apical than basal half. Abdomen shining black when viewed from behind, but when viewed from in front the segments are seen to be covered with pale grayish pruinescence. Legs fuscous, tibiæ and basal two tarsal joints of all legs pale brown. Wings clear, cross vein not infuscated or indistinctly so; veins brown. Halteres brown, knobs yellow. Hairs on body and legs yellowish.

Apical joint of palpi about one half longer than subapical, the latter slightly longer than the antepenultimate. Pronotum linear on upper half, reaching nearly to upper margin of mesonotum; hairs on mesonotum confined to the median and submedian lines. Hairs on abdomen rather sparse, regularly distributed; hypopygium almost identical with that of *palliatus* (Pl. XXXIII, Fig. 16). Fore tarsi bare, basal joint slightly longer than fore tibiæ (50:45); scalelike protuberance at apices of mid and hind femora large, mid and hind femora and tibiæ with long hairs. Third and fourth veins end respectively at an equal distance before and behind apex of wing; cubitus forking distinctly but not greatly beyond cross vein.

Female.—Agrees in coloration with the male except that the legs are generally darker, the pale color of tarsi being generally confined to the base of the first joint.

Length, 3–3.5 mm.

Type locality, Dubois, Ill., April 24, 1914 (C. A. Hart and J. R. Malloch). Swept from vegetation along bank of creek.

24. Chironomus palliatus Coquillett

Chironomus palliatus Coquillett, Proc. U. S Nat. Mus., Vol. 25, 1902, p. 95.

Larva.—Length, 6–7 mm. Yellowish or yellowish green. The condition of the larval exuviæ is such that a description is not possible beyond indicating that the labial plate (Pl. XXXII, Fig. 6) has the central tooth divided in the middle; that the mandibles are as in Figure

14, Plate XXX; that the ventral blood-gills are absent; and that there are six sensory hairs in each of the dorsal tufts.

Pupa.—Length, 6 mm. Yellowish brown. Frontal tubercles very small. Thoracic respiratory organs ending in numerous white hairlike filaments. Second abdominal segment with a series of about six transverse rows of short setulæ forming a band near the base on the dorsal surface, and the usual apical band of stronger black setulæ; segments 3–7 with the band near base, that on 7 being rather indistinct, segments 4–6 with short setulæ on dorsal surfaces which become more numerous near apices of segments, forming a slight band; lateral apical process of eighth segment ending in a sharp thorn, its sides with several shorter thorns (Pl. XXXI, Fig. 16); apical abdominal appendages more than three times as long as broad, densely fringed.

Imago; Male.—Black, opaque. Head fuscous, face and antennal flagellum yellowish; plumes of antennæ fuscous. Thorax black, anterior lateral angles and lateral vittæ deep brown, the median vitta and sometimes the median portion of mesonotum behind it as well as the inner portion of lateral vittæ pale reddish brown; lateral vittæ with dense whitish pruinescence; scutellum pale brown; postnotum black. Abdomen velvety black, the anterior lateral angles of the segments of the basal half sometimes brownish; hypopygium yellowish. Legs pale yellow; coxæ and generally also the greater part of fore and mid femora blackened. Wings clear, veins yellow, cross vein unclouded. Halteres yellow, sometimes slightly darkened apically. Hairs on body and legs pale yellow.

Frontal tubercles indistinguishable. Pronotum linear on upper half, not extending to upper margin of mesonotum. Hypopygium as in Figure 16, Plate XXXIII. Legs slender; fore tarsi without long hairs, basal joint nearly one half longer than fore tibiæ (53 : 37); mid and hind legs long-haired. Third vein ending nearly at wing-tip; cubitus forking very slightly beyond cross vein.

Female.—Similar in coloration to the male except that the mid tibiæ and apices of tarsi are usually distinctly browned.

Hairs of antennæ comparatively long, greatly exceeding the length of the apical joint. In other respects similar to the male.

Length, 3–4.25. mm.

Illinois locality, Thompson's Lake, near Havana, reared from larvæ dredged from a depth of eight and a half feet April 28 and May 1, 1914 (C. A. Hart and J. R. Malloch). The adults emerged May 12 and 14 respectively.

One reared specimen is a hermaphrodite, the bisexual characters lying in the antennæ, the basal third of the flagellum of both consisting

of the normal female joints, while the apical two thirds are of the form usual in the male and similarly haired (Pl. XXXII, Fig. 12). In other respects the specimen appears to be of the ordinary female form.

Originally described from Washington, D. C. I have seen specimens in the collection of the U. S. Bureau of Biological Survey from Plummer's Island, Md., taken by W. L. McAtee in June and August.

25. Chironomus riparius Meigen

Chironomus riparius Meigen, Klass. u. Beschr. Eur. Zweifl. Ins., Vol. 1, 1804, p. 16, sp. 3.
Chironomus annularis Macquart, Recueil Soc. Agric. Lille, 1826, p. 194, sp. 2.
Chironomus viridipes Macquart, ibid., p. 195, sp. 4.
Chironomus zonulus Zetterstedt, Ins. Lappon., 1838, p. 810, sp. 1.

Male.—Differs from *fasciventris* in having the fore tarsi bare and the basal joint half as long again as the fore tibiæ.

Female.—Differs from the female of *fasciventris* in having the basal joint of the fore tarsi comparatively longer, the proportions of this joint and fore tibiæ in specimens before me being 84, 54.

Length, 6.75–7.5 mm.

Illinois localities, Urbana, on window, April 11, 1911; and White Heath, in woods along bank of stream, November 22, 1913 (C. A. Hart and the writer).

I have as yet seen only females of this species and can not say what is the form of the hypopygium.

The larva, according to Van der Wulp and Weyenbergh, is transparent and pale green, but Johannsen states that larvæ from which he reared specimens he identified as *riparius* agreed with those of *decorus* in all details. Some error in observation must have occurred or else the European species is not the same as the American one.

Johannsen records *riparius* from Ithaca, N. Y., Washington State, Pennsylvania, South Dakota, Minnesota, New Jersey, and from Douglas, Alaska.

26. Chironomus tentans Fabricius

Chironomus tentans Fabricius, Syst. Antl., 1805, p. 38, sp. 3.
Chironomus abdominalis Meigen, Syst. Beschr. Eur. Zweifl. Ins., Vol. 1, 1818, p. 32, sp. 25.
Chironomus vernalis Meigen, Klass. Eur. Zweifl. Ins., Vol. 1, 1804, p. 13, sp. 5.

Male.—Pale green, opaque. Head pale yellowish green, antennæ, except the basal 2–3 joints of flagellum, fuscous; palpi fuscous, greenish at base. Mesonotum covered with whitish pruinescence, which is

not confined to the areas between vittæ but covers the latter, giving them an opaque appearance; vittæ deep black, the median vitta distinctly divided; pleuræ green, lower two-thirds of sternopleura and a large patch below wing-base blackened; scutellum yellow; postnotum black, yellowish at base. Abdomen black, segments with very narrow pale posterior margins; basal half with the segments narrowly gray pruinescent on posterior margins, apical half almost entirely covered with pruinescence, only the bases narrowly bare. Legs yellow, coxæ and trochanters more or less suffused with brown; apices of femora, bases and apices of tibiæ, and tarsi from near base of first joint suffused with brown. Wings clear, veins of anterior half brown, of the posterior half vitreous, cross vein infuscated. Halteres yellow. Antennal plumes deep yellow, body hairs whitish.

Frontal tubercles distinct; penultimate joint of palpi slightly shorter than antepenultimate and ultimate joints. Pronotum of moderate width, slightly concave in outline when viewed from the side, the upper extremity slightly produced, median dorsal excision shallow and narrow; hairs on mesonotum short and weak, mostly confined to areas between the vittæ. Abdomen with slight indications of a dorsomedian raised line on each segment; hypopygium as in Figure 1, Plate XXXIII. Fore tarsus bare, basal joint less than one fifth longer than tibia (5 : 4.25); mid and hind legs with soft hairs, the longest of which are barely longer than diameter of the joints upon which they are situated. Third vein ends beyond beginning of curve at apex of wing, the first at nearly two thirds the distance from cross vein to apex of third; cubitus forking distinctly beyond cross vein.

Female.—Similar to male in coloration except that the antennæ are yellow with the exception of the apical joint, and the mid and hind tibiæ have the bases either without any darkening or but slightly browned.

Length, 9–11 mm.

Illinois locality, Havana, April–May, 1914 (C. A. Hart and J. R. Malloch).

This species occurred in immense numbers on houses, fence posts, and tree trunks along and near the banks of the Illinois River at and near Havana on April 29, 1914, in company with *ferrugineovittatus*. *Crassicaudatus* resembles *tentans* in size and color, differing in having long hairs on the fore tarsi and in the structure of the hypopygium.

The larva of *tentans* has been described by Weyenbergh,* from whose description it is evident that it is very similar to larvæ belonging

*Tijdschr. v. Entom., Vol. 17, 1874, p. 149.

to the group which includes *decorus*, *viridicollis*, and others, which have the ventral blood-gills long and the first lateral tooth of labium much shorter than median and second lateral. It is not possible to associate definitely any larva from the Illinois River collections with that described by Weyenbergh, as his description is very unsatisfactory, but the larva described below is the only one that agrees in general appearance with that described by him, and occurring, as it does, in immense numbers in the places where *tentans* imagines do, it may, I believe, be assumed with a degree of certainty that it belongs to that species.

*Larva**.—Length, 24–27 mm. Blood-red. General appearance as in Figure 2, Plate XXXII; labium as in Figure 9, Plate XXIX; labial papillæ as in Figure 10, Plate XXIII; ventral blood-gills four in number, very long; dorsal blood-gills large; dorsal anal tufts consisting each of about six hairs, basal papillæ hump-like, not in the form of stalks.

The pupa has not been distinguished by the writer from that of *ferrugineovittatus* by any structural character owing to the absence of reared imagines.

The species was originally described from Europe, and has been recorded from New York, Idaho, South Dakota, Utah, and Iowa. I have seen it from Wisconsin.

Var. *pallidivittatus*, n. var.

This variety, which is mentioned by Van der Wulp, has not been given a name by means of which it may be distinguished from the type so far as I can discover. Some specimens taken at light at Flag Lake, near Havana, August 6, 1896, and at the same place June 29, 1897, differ from the type form in being smaller, averaging about 7 mm., and much paler, the thorax and abdomen being yellowish, the former with ferruginous vittæ and the latter with fuscous suffusion except at base; the legs are decidedly paler, the dark markings reduced to mere rings at apices of tibiæ and of the first two tarsal joints, while the apical three joints are browned. The antennal plumes are also much paler than in the type form.

This is probably the summer form of this species.

Type locality, Havana, Ill., August 7, 1895 (E. B. Forbes), and August 8, 1896 (C. A. Hart and C. C. Adams).

*This is "Chironomus larva (4)" mentioned by Garman in Bull. Ill. State Lab. Nat. Hist., Vol. 3, Art. IX, p. 160 (158, sec. ed.). 1888.

27. Chironomus ferrugineovittatus Zetterstedt
(Plate XXXII, Fig. 10)

Chironomus ferrugineovittatus Zetterstedt, Dipt. Scand., Vol. 9, 1850, p. 3492.

Larva.—Length, 45–60 mm. Blood-red. Ventral respiratory organs absent. For full description see an earlier article by the present writer*.

Pupa.—Length, 17–19 mm. Red, becoming yellowish before emergence of the adult.

Frontal tubercles of moderate size, slightly curved downward at apices. Thoracic respiratory organs terminating in numerous white, hairlike filaments; disc with a brown median line and another line of same color on each side above the portions occupied by vittæ of the enclosed imago, the surface not setulose but with about six weak hairs. Abdominal segments with a brown line on each side which is dilated at anterior extremity; disc of segments covered with very minute closely placed setulæ which almost cover their dorsal surface and are slightly longer posteriorly; surface hairs inconspicuous, one on each side of the median line near posterior margin much stronger than the others; apical lateral organ of eighth segment similar to that of *decorus,* and with the apical abdominal appendages mostly deep brown.

Imago; Male.—Differs from *plumosus* in having the vittæ and the dark marks on the basal four segments of abdomen usually bright ferruginous, the apical segment of the latter usually of the same color and the intervening segments gray or blackish.

Structurally the two species are very much alike, the principal difference being that the legs in *ferrugineovittatus* are noticeably thicker than in *plumosus* and the superior process of hypopygium much more slender. The proportions of fore tibiæ and basal 3 joints of fore tarsi are 105, 128, 70, 40. Hypopygium as in Figure 4, Plate XXXIII.

Female.—Similar to that of *plumosus;* differing in having the vittæ paler and the legs thicker.

Length, 12–13 mm.

Illinois locality, Havana. Abundant everywhere from the middle of April through a good part of May, also occurring in September in the imago stage. Larvæ occur throughout the year in the various lakes connected with the Illinois River at and near Havana and in some parts of the channel of the river. The writer was not successful in rearing the imago. Cast pupal skins were found in immense numbers along the shore of the Illinois River and floating on the surface of the

*Bull. Ill. State Lab. Nat. Hist., Vol. 10, Art. 4, p. 215. 1914.

river and connected lakes during the last week of April and the first week of May, 1914. As *tentans* occurred at the same time and place and no exuviæ from reared material are available for comparison there are no data for determining what percentage of each species was present, though they probably occurred in about equal numbers if one may judge from the imagines of each that appeared.

Originally described from Europe and recorded subsequently from Washington State.

28. Chironomus plumosus Linné

Tipula plumosa Linné, Syst. Nat., ed. 10, 1758, p. 587, sp. 19.
Chironomus plumosus (Linné) Meigen, Klass. u. Beschr. Zweifl. Eur. Ins., Vol. 1, 1804, p. 11, sp. 1.

Johannsen has provisionally identified as the larva and pupa of this species specimens taken from swamps in the vicinity of Cayuga Lake, Ithaca, N. Y. His descriptions are as follows: —

Larva.—"Blood red, length of body about 22 mm. Head brown, antenna short and stout, basal joint about half as long as the mandible; the latter with blackened teeth and with the usual mesad projecting setæ. Labrum, epipharynx, and hypopharynx were destroyed. Maxilla with short palpus and a mesad projecting lobe with setae and papillae. . . . Labium broad, with short blunt teeth [Pl. XXXII, Fig. 4]; the middle tooth broad, with a nearly straight apical margin, the first lateral small and more or less rounded, the second lateral broad and a little longer than the middle one; the third pair smaller and closely united with the second; fourth, sixth and seventh laterals about of equal size with rounded margins, the fifth slightly smaller. Anterior prolegs with very numerous fine hairlike setae. Ventral and anal blood gills present."

Pupa.—"Grayish brown in color; the markings of the enclosed imago visible; length about 16 mm. Respiratory filaments much branched and whitish in color. The dorsum of the abdominal segments uniformly covered with microscopic spines, those nearest to the posterior margins of the segments a little stouter than the others. The lateral fin on the eighth segment terminates in a chitinous process or spur, the extremity of which is divided into 7 or 8 spines in close contact. . . . Caudal fin with the usual fringe of matted filaments."

Figure 4, Plate XXXII, is a reproduction of Johannsen's figure of the larval labium.

Imago; Male.—Yellow, occasionally with a greenish tinge. Head yellow, antennæ with the exception of the basal 3 joints of flagellum

fuscous, the plumes brownish yellow; palpi brown. Mesonotum opaque, the vittæ gray, spaces between the latter with slight grayish pruinescence; sternopleura except the upper margin, a large spot in front of wing-base, and another in front of posterior spiracle, blackish; scutellum yellow; postnotum blackish gray. Abdominal segments broadly blackish brown on bases, leaving only the apical third of the basal four yellowish and only a narrow yellow apical margin to the others. Legs yellow, knees and apices of tarsal joints slightly obscured with brown. Wings clear, cross vein distinctly infuscated. Halteres yellow. Hairs on legs and body yellow.

Frontal tubercles of moderate size; apical joint of palpi longest, proportions of apical three joints, 22, 15, 15. Pronotum rather broad, central division, seen from above, wedge-shaped. Hypopygium similar to that of *ferrugineovittatus* (see Pl. XXXIII, Fig. 4), but the superior processes are slightly broader in comparison with their length, and the apical portion of the lateral arm is as shown in Figure 17, Plate XXXIV. Legs slender; fore tarsi with long hairs on posterior surface from middle of basal joint to near apex of third, proportions of tibia and basal three fore-tarsal joints, 98, 122, 63, 38; mid and hind legs with long hairs. Third vein ending as far before apex of wing as fourth does behind it; cubitus forking very slightly beyond cross vein.

Female.—In color similar to the male except that the legs have the apices of the joints, including the tibiæ, distinctly marked with brown, and the hind femora are usually darkened above on the apical half, and the bases of the fore femora are often slightly brownish.

Structurally it differs from the male in having the antennæ short, consisting of the usual 8 joints, and with short hairs, the body stouter, the legs with shorter hairs, and no long hairs on the fore tarsi.

Length, 12 mm.

Illinois localities: Urbana, April 11, and Champaign, July 21, 1887, the former at light (C. A. Hart).

This species was originally described from Europe, where it occurs in almost every place where there are small boggy pools. It has been recorded in North America from Mackenzie River in Canada, Chautauqua Lake and Ithaca, N. Y., and from Washington State. I have before me specimens taken at Lake Delavan, Wis., and Grand Junction, Mich., in September and July respectively, by Mr. Hart.

Johannsen was mistaken in supposing that the larva mentioned by Garman as "No. 4"* might be of this species. Although there are no reared specimens of the species at hand, the fact that *plumosus* does

*Bull. Ill. State Lab. Nat. Hist., Vol. 3, Art. 9, p. 160 (158, sec. ed.). 1888.

not occur in the localities where Garman collected, so far as our information goes, together with the fact that his No. 4 specimens do not agree with Johannsen's description, virtually proves that they can not be *plumosus*. It is almost certain that the species is *tentans*, the larva of which has not been definitely associated with the pupal and imaginal stages in connection with the work of this Laboratory.

29. Chironomus viridis Macquart

Chironomus viridis Macquart, Suites à Buffon, 1834, Vol. 1, p. 52. sp. 21.

Larva.—Length, 10–12 mm. Green, thoracic and last three abdominal segments reddish or brownish. Head slightly longer than broad; antennæ slender, basal joint about one and two thirds times as long as the remaining joints, second joint as long as the next two together, the other joints increasing in length to apex; labium as in Figure 2, Plate XXIX, the teeth very distinctly blackened; transverse fringe of epipharynx consisting of a central portion with five teeth, and another each side with generally three teeth on each; mandibles with four teeth, inclusive of the apical one, which are distinctly blackened, the usual hairs present. Apices of anterior pseudopods armed with soft hairs; abdominal segments without noticeable hairs; dorsal tufts consisting of about ten hairs, the basal papillæ very short; two long hairs above the bases of the upper pair of blood-gills; anal pseudopods with strongs brown claws at their apices; ventral blood-gills absent.

Pupa.—Length, 8–9.5 mm. Color very similar to that of larva. Frontal tubercles absent; thoracic respiratory organs with many white hairlike filaments. Dorsal surface of abdomen with a transverse row of numerous closely placed pale brown setulæ near the base of segments 2–6 (Pl. XXXI, Fig. 8, *a, b, c, d*), another row near apices of same segments, which becomes gradually less distinct on the last three of these segments and is sometimes interrupted at the middle, and the normal apical row of distinct, black, thornlike setulæ at apex of second segment (Fig. 7); lateral apical process on segment eight with about eight short leaflike apical thorns (Fig. 6); apical processes of abdomen as long as eighth segment, their outer margins with numerous long, flattened hairs.

Imago; Male.—Bright green. Head green; antennæ yellow, flagellum and plumes brown. Thoracic vittæ, a spot below wing-base, the sternopleura, and postnotum reddish or yellowish. Abdomen generally entirely green with the hypopygium yellowish. Legs greenish

yellow; mid and hind tibiæ with a black apical comb; apical joint of all tarsi brownish. Hairs on legs and body whitish.

Hairs on spaces between the thoracic vittæ and on central line long and soft, those in front of wing-base not numerous; scutellar hairs long and soft. Abdomen slightly broadened from middle to apex of penultimate segment, last segment much narrower than the preceding segment and equal to the width of hypopygium basally. Basal joint of fore tarsus one fifth longer than fore tibia; the apical half of basal and whole of second joint of fore tarsus with long hairs on the posterior surface; mid and hind legs with rather long soft hairs. Posterior branch of radius and media reaching wing-margin at about the same distance from wing-tip before and behind respectively (Pl. XXXIX, Fig. 4); cubitus forking slightly beyond the vertical line of the cross vein.

Female.—Similar in color to the male, except that the antennæ are almost entirely greenish yellow, the apical joint only being brownish.

The legs differ from those of the male in being much shorter-haired, the fore tarsus being devoid of long hairs; the tarsal proportions are the same in both sexes. Wings broader than in male, and the cubitus forks almost directly below the cross vein.

Length, 5–6.5 mm.

Illinois localities: Illinois River at Havana, April–June, 1914. Hundreds of larvæ of this species were obtained from a clump of *Ceratophyllum* dredged from the bottom of Thompson's Lake, Havana. These were readily reared in vials in the Laboratory, and the descriptions herewith given are based on the series thus obtained. The immature stages have not been previously described.

Originally described from Europe. C. W. Johnson has recorded it from Florida.

30. Chironomus pseudoviridis, n. sp.

This species resembles *viridis* so closely that it is only necessary to indicate the points of difference between them.

Male.—The mesonotum has generally distinct whitish pruinescence between the vittæ, which is absent in *viridis;* the fore tibia is slightly longer than the basal joint of the tarsus; the cubitus forks slightly distad of the cross vein; and the third vein ends considerably farther from the apex of the wing (Pl. XXXIX, Fig. 1). Hypopygium as in Figure 2, Plate XXXIII.

Female.—Similar to the male in color.

Differs structurally from *viridis* in having the antennal joints much shorter, the basal five joints of flagellum being each less than half as long as the apical one, while in *viridis* they are much more elongate, over half as long as the apical joint.

Length, 3.75–4.25 mm.

Type locality, Urbana, Ill., August 5, 1914 (C. A. Hart and J. R. Malloch). Paratype from South Haven, Mich., July 14, 1914 (C. A. Hart).

According to the classification of other authors this species would be placed, not in *Chironomus* but in *Orthocladius*. The writer, however, considers that from its close resemblance structurally to *viridis* it is more closely related to that species than to *Pseudochironomus*—which differs from *Orthocladius* (sens. lat.) only in the form of the hypopygium—in which genus the use of the accepted generic characters would cause him to place it.

Two females sent me by Professor Johannsen which are labeled *fulviventris* belong to two distinct species. One of them is, I am convinced, *pseudoviridis*, but the other is in all respects in agreement with Johannsen's description of *fulviventris*. The venation and leg proportions of the latter are the same as those of *viridis*, but the male differs from that species in color, and also in having the fore tarsi bare, as stated in the original description. The locality for Professor Johannsen's specimen is Ithaca, N. Y.

It is with considerable hesitation that I am describing this species as new, but owing to the evident uncertainty that seems to exist regarding the identity of *fulviventris*, even with its describer, and because of discrepancies between my specimens and the original description, I can take no other course.

I have seen a large number of specimens taken at Lake Mendota and Madison, Wisconsin, in June, 1912. Most of the specimens were taken from large swarms, the sexes occurring in different swarms. The time of flight of one swarm of females is given on label as 8 p. m. (A. C. Burrill).

The Wisconsin specimens differ from the type series in having the thorax shining, and in the only male which has the legs intact the fore tarsi are devoid of long hairs. These hairs are readily rubbed off, and as in other respects the agreement is perfect I consider them as *pseudoviridis*.

31. Chironomus abbreviatus, n. sp.

This species bears a strong resemblance to *festivus*. It differs in being smaller, 7.5 mm., in having the legs less distinctly browned, in

that the apices of the abdominal segments are without the small warts, only the basal four blackened, and in the form of the hypopygium (Pl. XXXIV, Fig. 18), the inferior and superior processes being much abbreviated. The basal joint of fore tarsi is about one and a half times as long as fore tibiæ (66: 45, 75: 50, 2 specimens). Otherwise as *festivus*.

Type locality, Havana, Ill., September; two males.

Early stages unknown.

32. Chironomus frequens Johannsen

Chironomus frequens Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 230.

Male.—Green, slightly shining. Head yellowish; antennæ yellow, flagellum brown except at base, the plumes pale brown. Thorax in living specimens greenish, becoming yellow after death, vittæ very little darker than the ground color; postnotum not darker than scutellum. Abdomen without markings. Legs green or yellowish; apical third of fore tibiæ and extreme apices of mid and hind pairs, apical third of basal joint of fore tarsi, base and apex of second joint, and remaining joints blackish brown, the pale portion of the tarsi of fore legs whitish; mid tarsi blackened on apices of the basal two joints, as also are the whole of their apical three; hind tarsi blackened on the apices of the basal three joints, as also are the whole of the apical two. Wings clear, veins yellow, cross vein not infuscated. Halteres green.

Frontal tubercles absent. Pronotum linear on upper half. Hypopygium as in Figure 6, Plate XXXIII. Fore tarsi with long delicate hairs; basal joint about a fourth longer than fore tibiæ (56:45). Third vein ending as far before apex of wing as fourth does behind it; cross vein at middle of wing; cubitus forking slightly but distinctly beyond it.

Female.—Agrees in color with the male with the following exceptions: the general color is a deeper green, the last antennal joint only is fuscous, the mesonotum is generally unicolorous, and the legs have the dark marks more intense and rather broader.

Length, 3.5–4.5 mm.

Illinois localities: Havana, June 5, 1896 (C. A. Hart); Peoria, June 15, 1914, on window in hotel (J. R. Malloch). I have seen specimens of this species from Ithaca, N. Y., the original locality, submitted by Professor Johannsen.

The early stages are undescribed.

33. Chironomus stigmaterus Say?

Chironomus stigmaterus Say, Jour. Acad. Nat. Sci. Phil., Vol. 3, 1823, p. 15.

Male.—Yellow (probably greenish when alive). Head dull yellow; antennæ fuscous, becoming paler towards apex, the plumes yellowish brown; palpi brown. Mesonotum with reddish yellow vittæ; lower half of sternopleura reddish; postnotum reddish brown. Basal four segments of abdomen slightly browned on dorsum and lateral margins of basal half, the remaining segments grayish, all segments with slight whitish pruinescence. Legs yellow, apices of tarsal joints of all legs narrowly browned. Wings clear, veins yellow, cross vein and small portion of connected veins brown.

Frontal tubercles rather long and stout. Hypopygium identical with that of *ferrugineovittatus*. Fore tarsi from middle of basal joint, and mid and hind tibiæ and tarsi with very long hairs; basal joint of fore tarsi slightly more than a third longer than fore tibiæ (85:63). Third vein ends very slightly farther from apex of wing than fourth does behind same; cubitus forks directly below cross vein.

Female.—Differs from the male in being darker in color, the vittæ brown, and the abdominal segments except the apices grayish.

The leg proportions are as in the male, but the long hairs are absent. In other respects agrees with the male except in sexual characters.

Length, 7.5–8 mm.

Locality, Oak Creek, Lincoln, Nebraska, October 16, 1898 (C. A. Hart).

Early stages unknown.

This species closely resembles *ferrugineovittatus,* differing principally in size, color, and proportionate lengths of fore metatarsus and fore tibia. I have some doubt as to the identity of this species with that described by Say, and that which was considered as Say's species by Johannsen. The latter gives the length of the basal joint of the fore tarsi as exceeding that of the fore tibiæ by about one fifth, while in my specimens it is considerably greater. The specimens Johannsen had were from Kansas, Washington State, California, Wisconsin, Idaho, New Jersey, and South Dakota. Say's original record gives only United States.

34. Chironomus crassicaudatus, n. sp.

Male.—Yellowish green, opaque. Head yellow; scape of antennæ and base of flagellum yellowish, the remainder fuscous, plumes pale

brown; palpi brownish yellow. Mesonotum with gray or brown vittæ, the disc with faint whitish pruinescence; sternopleura reddish except on upper margin; postnotum brown. Abdominal segments each with the basal half blackish brown, the dark color usually extending posteriorly on median line, or with a broad brown band on basal half which does not extend to the extreme base. Legs greenish yellow, knees, and apices of tibiæ and of the tarsal joints narrowly brown. Wings as in *stigmaterus (?)*.

Frontal tubercles large; palpus as in Figure 1, Plate XXXII. Hypopygium as in Figure 13, Plate XXXIII; lateral view as in Figure 13, Plate XXXIV. Surface hairs on fore tarsi and mid and hind legs shorter than in *stigmaterus (?)*; basal joint of fore tarsi slightly less than one fourth longer than fore tibiæ (98:80). Venation as in *stigmaterus (?)*.

Length, 8 mm.

Type locality, Peoria, Ill., October 22, 1914, at light (C. A. Hart). Paratypes from Lake Lomalta, Texas, November 27, 1910 (C. A. Hart); and from Katherine, Texas, December 3, 1911 (C. A. Hart).

Female and early stages unknown.

The male of this species is readily separated from any other species of the *plumosus* group by the form of the hypopygium.

35. Chironomus pallidus Johannsen

Chironomus pallidus Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 230.

Male.—Pale green. Head green; scape of antennæ yellow, flagellum greenish at base, the remainder fuscous, plumes brownish, paler at apices; palpi brownish black. Thoracic vittæ reddish yellow; pleuræ with a longitudinal black streak on middle extending from anterior margin midway to posterior margin; sternopleura reddish; postnotum glossy black. Abdomen entirely pale green, rarely yellowish at apex. Legs pale yellowish or greenish, knees, apices of tibiæ, and apices of basal joint of fore tarsi narrowly blackened. Wings clear, veins yellow, the cross vein clear. Halteres yellow.

Antenna slightly longer than head and thorax combined; palpus about twice as long as height of head; eyes rather widely separated above. Mesonotum much enlarged in front, obliterating the pronotum, which is linear on the anterior surface of the mesonotum to the level of the upper margin of head; discal hairs of mesonotum and scutellum not conspicuous. Abdomen slender, last 3 segments slightly widened; surface hairs soft and pale, not very long; hypopygium as in Figure 4, Plate XXXIV. Legs slender; fore tarsi without long hairs, basal

joint one third longer than tibia (80:60), second joint slightly longer than third; mid and hind legs with the hairs on femora and tibiæ about equal to the diameter of the joints which bear them. Third vein almost straight, costa reaching beyond the beginning of apical curve; cross vein at wing-middle; cubitus forking slightly distad of the cross vein.

Female.—Similar to the male in color except that the antennæ have only the apical joint fuscous and the legs have the black portions rather broader, especially on the fore knees, where the bases of the tibiæ are rather broadly black.

The antennæ are short, about equal in length to the palpi; the body is stouter than in the male, the abdomen particularly so, and the venation differs from that of the male in that the third vein is distinctly curved.

Length: male, 4–5 mm.; female, 3–3.5 mm.

Illinois locality, Momence, July 17, 1914. A series of five males and four females taken at light by Mr. Hart.

Originally described from Ithaca, N. Y.

Early stages undescribed.

36. Chironomus aberrans Johannsen

Chironomus aberrans Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 221.
Chironomus fascipes Coquillett, Proc. Ent. Soc. Wash., Vol. 9, 1908, p. 145.

Female.—Yellow, with a slight greenish tinge. Head yellow, antennæ concolorous, palpi fuscous. Mesonotum with reddish vittæ, the spaces between them slightly whitish pollinose; postnotum blackish brown. Basal 2–3 segments of abdomen greenish yellow, the others blackish with pale posterior margins. Legs yellow, mid and hind knees, apices of all tibiæ and of the joints of fore tarsi narrowly brown, apices of fore femora and bases of fore tibiæ broadly brown. Wings clear, cross vein not infuscated.

Pronotum linear, not extending to upper margin of mesonotum, the latter much produced above at anterior margin. Legs rather stout, their surfaces with a few long hairs; basal joint of fore tarsi about a fourth longer than tibia (80:65). Cubitus forking very slightly beyond cross vein.

Male.—Agrees with the female in color except that the abdomen has only the apical three abdominal segments blackened.

The fore tarsi have no long hairs, and the hypopygium is very similar to that of *fallax* (Pl. XXXIII, Fig. 7) except that the superior process is considerably stouter and less distinctly curved.

Length, 5–6 mm.

I have seen a female specimen of this species, taken by Mr. Hart at Cedar Lake, Indiana, July 17, 1914. This locality is very close to the Illinois line, and it is extremely probable that the species occurs in this state, though so far we have no record of it. A male in the collection here was taken by Mr. Hart at Delavan Lake, Wis., September 6, 1892. Three females taken by A. C. Burrill at Madison, Wis., June 2–9, 1912, one of them on peonies, differ from the description given here in being bright green with brown markings.

Originally described from Ithaca, N. Y., and from Pennsylvania, Washington State, and New Jersey. Coquillett described *fascipes* from New Jersey. I have seen a series of both sexes, submitted by Mr. E. T. Cresson, from Pennsylvania.

Early stages undescribed.

37. Chironomus nigrovittatus, n. sp.

Male.—Bright green, shining. Head green; antennæ brown, scape shining black, plumes pale brown; palpi yellowish brown. Mesonotum with very faint pruinescence, the vittæ deep black; sternopleura and an irregular patch below wing-base blackened; postnotum yellowish at base, blackened on dorsum. Abdomen fuscous-green. Legs green, apices of fore femora, whole of fore tibiæ, and fore tarsi from before apex of basal joint brownish; mid and hind legs with black apical tibial mark, and the apical joint of tarsi brown. Wings clear, cross vein unclouded. Halteres green.

Frontal tubercles indistinguishable. Pronotum linear. Hypopygium as in Figure 2, Plate XXXIV. Fore tarsi without long hairs, basal joint nearly one half longer than fore tibiæ (25 : 17), apical joint of mid and hind tarsi slightly broadened. Third vein ending distinctly farther from apex of wing than does fourth; cross vein slightly before middle of wing; cubitus forking very slightly beyond cross vein.

Female.—Similar to the male except in the usual sexual characters and in having the abdominal segments with narrow pale posterior margins.

Length, 1.5–2.25 mm.

Type locality, St. Joseph, May 3, 1914 (J. R. Malloch). Paratypes from Berrien Springs, Mich., July 16, 1914, at light (C. A. Hart).

A male specimen taken at South Haven, Mich., July 15, 1914, at light, by Mr. Hart, differs from the type form in having the vittæ red-

dish brown and the abdomen grass-green darkened apically. In other respects the agreement is perfect.

The early stages are unknown to me.

38. Chironomus harti, n. sp.

Female.—Head brownish yellow; antennæ yellow, scape and apical joint brown; palpi brown. Thorax yellowish, opaque, vittæ, greater portion of sternopleura, and spot below wing-base brown, opaque, disc of mesonotum with grayish pruinescence between the vittæ; postnotum blackish brown. Abdomen blackish brown, opaque, posterior margins of segments narrowly pale. Legs whitish yellow, apices of mid and hind tibiæ narrowly brown; apices of tarsi slightly browned. Wings clear, veins pale yellowish; cross vein not infuscated. Halteres whitish yellow. Body hairs pale brown.

Frontal tubercles absent. Pronotum linear. Legs rather stout; basal joint of fore tarsi about a ninth longer than fore tibiæ (21 : 19); mid and hind legs with moderately long hairs; empodia small, pulvilli indistinguishable; apices of hind tibiæ with the normal comb. Third vein ending slightly farther in front of apex of wing than fourth does behind it; cross vein distinctly, but not greatly, before wing-middle; cubitus forking distinctly beyond cross vein, its posterior branch forming a rather obtuse angle with the anterior one, so that its apex is almost in line with apex of basal third of anterior branch.

Length, 1 mm.

Type locality, Urbana, Ill., September 5, 1914, at light in city (C. A. Hart and J. R. Malloch).

Named in honor of my colleague, Charles A. Hart.

Early stages and male unknown.

39. Chironomus viridicollis Van der Wulp

Chironomus viridicollis Van der Wulp, Tijdschr. v. Ent., Vol. 2, 1858, p. 161.

Larva.—Length, 8–10 mm. Blood-red. Head yellowish, about a third longer than broad, posterior margin, anterior margin of labium, teeth of mandibles, and the eye spots blackish brown; disc of ventral surface brownish; labial plate (Pl. XXIX, Fig. 10) similar to that of *decorus,* the central tooth rounded; mandible with 4 teeth, including the apical one, on inner ventral surface, and one much paler in color and distinctly smaller on the dorsal surface at base of apical tooth; labial papillæ similar to those of *tentans* (?); basal antennal joint stout, its length nearly equal to that of mandible and four times its own diameter, sensory organ about one fourth from base; second joint about

equal in length to two thirds the apical diameter of basal joint; third about one fourth as long as second and half as long as fourth, fifth acute apically, about as long as third; apical unjointed appendage of basal joint extending almost to apex of fifth joint; dorsal surface of head with long slender hairs, situated as follows: four on labrum, one slightly in front of each antenna near suture of median sclerite, one on posterior outer surface of the raised base of antenna, one on each side of median sclerite at the point where the sutures begin to converge anteriorly, one on each side of same sclerite where the sutures begin to converge posteriorly, and three on each lateral sclerite, two of which are almost in transverse line with the posterior pair on median sclerite and the other slightly posterior to the anterior pair on that sclerite; and in addition to these hairs there are the usual two long ones close to eye spots on each lateral margin; ventral surface with four hairs, one on each side at base of labial plate almost in longitudinal line with outer labial tooth and the other about one third of the distance from the anterior pair to the posterior margin of head and considerably nearer to median line; ventral respiratory organs present on penultimate abdominal segment; dorsal tufts consisting of six hairs.

Pupa.—Length, 6–8 mm. Brownish yellow, margins of wing pads, appendages of thorax, lateral margins of abdominal segments and of apical appendages blackened. Thoracic respiratory organs ending in numerous white filaments; frontal tubercles as in *decorus* (Pl. XXXI, Fig. 12); dorsum of thorax with closely placed scalelike setulæ; first dorsal abdominal segment without setulæ, several weak hairs on the surface; segments 2–6 with disc, except the lateral margins, covered with distinct setulæ which are slightly larger and more closely placed posteriorly; seventh segment with a few much weaker setulæ, in groups of 2 or 3, on anterior half; eighth segment with weak setulæ on lateral margins extending nearly to median line posteriorly; all segments with several weak hairs; lateral margins of segments each with four or five long hairs, those on eighth segment most distinct; apical lateral appendage of eighth segment as in *decorus* (Pl. XXXI, Fig. 3); apical abdominal appendage with fringe of long flattened hairs.

Imago; Male.—Yellowish green, shining. Head yellow, antennæ fuscous, scape shining black, base of flagellum yellowish; palpi fuscous; antennal plumes blackish. Mesonotum with the vittæ shining black; sternopleura, a spot in front of wing-base, and postnotum blackish. Abdomen blackish green, posterior lateral angles of segments broadly yellowish, the yellow parts with distinct whitish pruinescence. Legs greenish yellow, mid and hind coxæ, apices of fore femora, bases

of all tibiæ, apices of fore tibiæ, almost the entire fore tarsi, the last 3–4 joints of mid and hind tarsi, and the narrow apices of mid and hind tibiæ brownish. Wings clear, veins yellowish, cross vein infuscated. Halteres yellow.

Frontal tubercles distinct; antenna slightly longer than head and thorax combined. Hypopygium similar to that of *decorus* (Pl. XXXIII, Fig. 11). Legs slender; fore tarsi without long hairs, basal joint less than one half longer than fore tibiæ (90:65); mid and hind legs with moderately long hairs. Third and fourth veins ending about an equal distance from apex of wing; cubitus forking almost below cross vein.

Female.—Agrees with the male in color.

Length, 7–8 mm.

Illinois localities: Champaign, Urbana, Chicago (Thirty-ninth Street Pumping Station), Havana, and various points on the Illinois River as far north as Marseilles, above the dam, April, June, and November.

This European species has been reported from New Jersey (Johnson) and from Ithaca, N. Y. (Johannsen). I have seen specimens from Pennsylvania and Maryland.

The larvæ of *viridicollis* were found in the reservoir for the supply of the city water of Champaign, Ill., by the writer December 29, 1914. They were nearly full-grown at that time, although several specimens were found whose size would have indicated probably but six or seven days' growth under normal summer conditions. It is possible that these small specimens were retarded in growth by the advent of cold weather, though it is not impossible that they were the result of pædogenesis, which occurs in allied genera. The absence of oxygen or its comparative scarcity in water obtained from deep wells can have little or no detrimental effect upon larvæ of this species or its allies, since they are found at great depths in lakes where there is scarcely any oxygen; and the presence of algæ and diatoms in wells, even of considerable depth, secures to the larvæ an abundance of their principal food. It being practicably impossible to prevent these insects from obtaining access to reservoirs and wells, measures must be taken periodically for their reduction or extermination. This is a difficult problem in the case of large reservoirs, and it is still more difficult to protect wells. Here the introduction of certain species of fish may be a successful measure—a course not possible, however, where large quantities of water are drawn off by pipes, even if these have perforated caps, since very small fish would, notwithstanding, pass into the pipes and cause more trouble than the chironomids.

Larvæ that were brought to the laboratory from the reservoir for the supply of city water to Champaign, were subjected to a test by means of freezing. Specimens that were placed in a shallow dish containing but a small quantity of water were frozen solid by exposure over night and never recovered, while those that were put in a larger container, and were therefore not so completely frozen, survived in the great majority of cases. This test was made in order to ascertain whether, like many larvæ and pupæ of other orders, this species could withstand freezing, and the conclusion, though based on rather meager data, was that the larvæ could not survive complete freezing. It seems possible, then, where two tanks are available for alternate use, to rid city drinking-water of these larvæ in cold winter weather by drawing off all the water from the infested tank, and not replenishing it for five or six days. As the larvæ invariably live in cases fastened to the sides of the reservoirs or burrow in whatever detritus may be on the bottom, and are seldom found free in the water, probably but few would be drawn off in the operation of emptying the reservoir. The same expedient of emptying reservoirs, alternating between tanks every five or six days, would, I am sure, in summer prevent the species from breeding in these receptacles. Imagines of the species which have been obtained from the city water here are of general occurrence throughout the year from April to December, their life cycle in summer occupying about thirty days. As from four to six days are passed in the egg stage, if a reservoir were emptied often during the warmer period of the year, allowing the inside to become thoroughly dry and thus destroying the eggs and killing the larvæ, it is possible that the species could be exterminated where two tanks are available for alternate use. It is, however, necessary to indicate that the same species may occur in almost any body of water, clean or polluted, and, in the imaginal stage, travels for considerable distances, accordingly, measures for protection in order to be successful must be carried on without intermission during the breeding period. From the first of December to the last of March danger of infestation is remote in this latitude except in unusually mild seasons.

The presence of larvæ of *Chironomidæ* in water affords no criterion by which to judge of its purity or impurity. They may be found in water that is perfectly safe for drinking purposes, since it usually contains sufficient minute vegetable organisms for their food; and, finding this, they seem to thrive also in water which is absolutely unfit to drink. The presence of larvæ in any body of water simply signifies that it affords them suitable conditions for life and growth.

In this connection it is interesting to note that larvæ of *viridicollis* and *decorus,* which are blood-red and possess four long ventral respiratory organs, *lobiferus,* which is blood-red and possesses two very short ventral respiratory organs, and *Protenthes culiciformis,* which is whitish and has no ventral respiratory organs, were all commonly represented in collections made in the Illinois River both in the portions where the water is polluted by the Chicago sewage and where it is comparatively clean.

Various biological observations, and inferences and conclusions based on them, have been published from time to time concerning this insect and allied species, and two accounts of the latter class are now briefly referred to in connection with kindred observations, offsetting facts, and, in some cases, independent judgments of my own.

A. B. Gahan has reported the occurrence of the larvæ of *Chironomus dorsalis* Meigen in a twenty-five-foot well, containing four or five feet of water, at College Park, Md., during October and November*.

Larvæ captured from this well were placed in two beakers of the well water, one containing the clear water, the other having placed in it a little clay silt from the bottom of the well. Both lots of larvæ sank straight to the bottom of the beakers. Those in the clear water are reported as thriving during the confinement. Concerning the others he says: "Somewhat to my surprise, it was soon evident that those in the beaker containing the clay were not prospering. Their constant wriggling tended to draw them down into the mud, from which they were unable to extricate themselves. At first it was thought that the larvæ were attempting to conceal themselves, but it soon became evident that this was not the case. The following morning all except three or four of those in this beaker were found to be dead, having apparently succumbed to suffocation."

Observations made by the writer differ from the above in that the observed larvæ in almost every case burrowed into the mud or other matter in the bottles or other receptacles in which they were kept. Experimental borings have proven that some of the "blood-worms" will burrow twelve inches or more into the soft mud at the bottom of lakes connected with the Illinois River; and borings made in 1914 in the presence of the writer revealed larvæ at a depth of eight inches in the bottom of one of these lakes (Thompson's) near Havana.

Gahan states, following Miall, that the larva of *dorsalis* is one that is adapted to living in deep water, and that this is the reason why it was brought up by the pump, the screen of the latter being near the

*Proc. Ent. Soc. Wash., Vol. 14, 1912, p. 102.

bottom of the well. That these larvæ, having hæmoglobin in the blood, are, by its presence, adapted to living in deep water is a generally accepted view, but one difficult to reconcile with the fact that associated with these larvæ at great depths, and under anaerobic conditions are to be found larvæ of other species which presumably have no hæmoglobin in the blood since they are either whitish or greenish in color instead of red. It is also well known to students of the group that many of the blood-red species occur in puddles and shallow pools and streams. In commenting on Mr. Gahan's report "Dr. Dyar said that the presence of the larvæ in the well was probably induced by the wooden walls, which would furnish food. He thought no larvæ would be found in the wells entirely lined with stone, as is ordinarily the case."* As previously stated, the larvæ of this group of species live upon algæ and diatoms, and occur in wells or reservoirs the sides of which are of stone or concrete.

A. C. Burrill has referred to the "green specks" exuded by imaginal *Chironomidæ,* and raises the question as to whether the color of these is due to their having fed upon green algal matter in the "prepupal" stage.† It may be pertinent to indicate that imagines of all orders, as far as is known to the writer, after attaining full expansion of wings and a degree of maturity that enables them to take flight, exude a certain amount of fluid that as a general rule partakes of the same general color as the insect. Students of *Lepidoptera* in particular must be well aware of this fact, and know that while in some species the color of the fluid is red in others it is white, or even greenish. The well-known reports of "showers of blood" in the Mediterranean region have been traced to the simultaneous emergence of large numbers of *Vanessidæ,* and other *Lepidoptera,* following a shower of rain which provided the required conditions for that emergence. It is thus not only a probability but a fact that the green specks referred to by Burrill partake of this same nature. In the case of the specimens reared by the writer from the city water of Champaign the green exudations were very pronounced, though green algæ could have formed but a very small portion, if any, of the food of the larvæ.

An attempt was made by the writer to ascertain how long the imagines of *viridicollis* would live under laboratory conditions. Upon emergence the imagines were placed in one-ounce bottles, which were corked and laid close to a window where they would be least subject to the indoor conditions. The room was kept, by means of automatic heaters, at a fairly even temperature of 70 to 75 degrees F., but the

*Loc. cit., pp. 104–105.

†Bull. Wis. Nat. Hist. Soc., Vol. X, 1913, p. 139.

air in the bottles must have averaged very considerably less as the glass remained uniformly cold, and the probable temperature must have been 60 degrees or less. The conditions under which the imagines were confined were, of course, not natural, but indicate that the length of life under more advantageous conditions may be even longer than in this laboratory test and make it reasonably certain that it exceeds one to two days, as has been stated by various writers. A male that emerged and failed to leave the water was allowed to lie on the surface for twenty-four hours, at the end of which time it was still alive.

The duration of life of the eleven imagines that were confined in the bottles is appended.

Emerged Jan. 14, 1 female, 1 male; female died Jan. 21, evening, male, Jan. 22, evening.
Emerged Jan. 15, 1 female; died Jan. 25, evening.
Emerged Jan. 16, 2 females; died Jan. 25, evening.
Emerged Jan. 17, 2 males; one died Jan. 26, morning, the other Jan. 27, noon.
Emerged Jan. 18, 1 male, 1 female; both died Jan. 28, male, morning, female, evening.
Emerged Jan. 19, 1 male, 1 female; both died Jan. 27, morning.

The above record indicates an average duration of life of nine and a half days.

A female which emerged February 3 was left on the glass side of the aquarium for the purpose of ascertaining whether the difference between the air in this situation and that contained in the bottles used in the other experiment would make any difference in the length of life of the adult. The space between the water in the aquarium and the single sheet of writing paper with which the latter was covered was about two inches. This paper cover was laid loose on top, being held in position by a small note-pad which did not cover the entire area of the aquarium. Despite the fact that on the 7th, 8th, and 9th of February the specimen was found struggling on the surface of the water and had to be removed therefrom and placed on the dry surface of the aquarium—thus probably shortening its life—it lived until the evening of February 11, or slightly over eight days. On the 7th of the month eggs were deposited in the water. The form of the mass was tubular, the entire tube being about 12 mm. in length and nearly 2 mm. in diameter. Only the lower 6 mm. of the tube contained eggs, which were arranged in regular circles. The computed number of eggs was slightly over 450. The apex of the tube was attached to a small piece of floating detritus. The eggs were preserved in alcohol four days after they were laid.

40. Chironomus dimorphus, n. sp.

Male.—Thorax greenish yellow, abdomen black. Head yellow; scape of antennæ yellow, flagellum and plumes fuscous; palpi reddish or brownish. Mesonotum opaque, the disc slightly pruinescent; vittæ reddish or reddish brown; postnotum blackish brown, paler at base. Abdomen fuscous, shining; anterior lateral angles of segments usually with an elongate longitudinal yellow streak. Legs pale straw-colored, last tarsal joint generally brownish. Wings clear, veins yellow, cross vein unclouded. Halteres yellow.

Frontal tubercles indistinguishable; antennæ about one and a half times as long as head and thorax together; pronotum linear on upper half. Hypopygium as in Figures 11, 12, Plate XXXIV. Legs long and slender; fore tarsi without long hairs, basal joint about one fifth longer than fore tibiæ (60:50); mid and hind legs with moderately long hairs; basal joint of hind tarsi a fourth shorter than hind tibiæ and less than twice as long as second joint (65, 52, 30). Wings slender, third and fourth veins ending at equal distances from apex of wing; cubitus forking almost directly below cross vein.

Female.—Fuscous or black. Head dull yellow; antennæ pale yellow, apical joint and palpi brownish. Thorax with slight whitish pruinescence between vittæ, opaque black except on vittæ, which are slightly shining; scutellum black. Abdomen black, shining, posterior margins of segments sometimes narrowly yellow. Legs yellow.

Differs from the male in having the wings broader and in the usual sexual characters.

Length, 6–7 mm.

Type locality, Carbondale, Ill., April 23, 1914, taken on bank of Crab Orchard Creek (C. A. Hart and J. R. Malloch); paratypes taken by the same collectors in the following Illinois localities: Dubois, Monticello, and Muncie on dates in April, May, and June, the latest date being for the specimen taken at Monticello. A single paratype from Plummer's Island, Md., August, 1907, is in the collection of the U. S. Bureau of Biological Survey (W. L. McAtee). It is labeled (by Coquillett) "? *jucundus* Walker," but Walker's description, though very brief, obviously can not apply to the present species.

I have examined a large number of specimens of this species taken by A. C. Burrill at Madison, Wisconsin, June, 1912. Many of the males bear labels to the effect that they were taken from swarms flying at 7:45 and 7:50 p. m.

This is probably the species identified as *albistria* Walker by Johannsen. As Walker's description of legs does not agree with that

of *dimorphus* and is altogether lacking in several important details, I do not consider that his species described from "St. Martins Falls, Albany River, Hudson's Bay," can possibly be the same as the Illinois species.

41. Chironomus abortivus, n. sp.

Male.—Pale green, slightly shining. Head yellowish; flagellum of antennæ fuscous, yellowish basally; antennal plumes yellowish brown; palpi yellow. Mesonotum with reddish yellow vittæ; pleuræ mostly suffused with yellowish red; postnotum reddish. Abdomen without distinct dark marks. Legs greenish yellow; apices of tibiæ narrowly blackened; apices of basal two joints of fore tarsi and whole of apical three blackened; mid and hind tarsi blackened from near apex of third joint to tips. Wings clear, veins pale yellow, cross vein not infuscated. Halteres greenish yellow.

Frontal tubercles indistinguishable. Hypopygium as in Figure 9, Plate XXXIV. Fore tarsi without long hairs, basal joint more than a third longer than fore tibiæ (50:35); mid and hind legs with long hairs. Third vein ending at about the same distance in front of apex of wing as fourth does behind same; cubitus forking very slightly beyond cross vein.

Female.—Differs from the male in having the antennæ generally yellow except the last joint, which is fuscous, and in the usual sexual characters.

Length, 4–5 mm.

Type locality, Urbana, Ill., September 5, at light; paratypes from Havana, Ill., April 28, on bank of the Illinois River,—all taken by Mr. Hart and the writer in 1914. A female specimen was taken at South Haven, Mich., July 15, 1914, at light, by Mr. Hart. This specimen is rather larger than the females from the other localities mentioned, and has the apices of the fore tibiæ less conspicuously blackened, but is obviously the same species. Specimens that agree with the type have also been seen by me from Mendota Lake, Wis., June 8, 1912 (A. C. Burrill).

42. Chironomus fusciventris, n. sp.

Male.—Reddish yellow, slightly shining. Head yellow, flagellum of antennæ, except the extreme base, and plumes pale fuscous; palpi reddish yellow. Mesonotum with rather indistinct reddish vittæ; postnotum brown. Abdomen fuscous, anterior lateral angles of segments yellow. Legs pale yellow, apical tarsal joint brownish. Wings clear, veins yellow, cross vein not infuscated. Halteres yellow.

Antennæ elongate, over one and a half times as long as head and thorax combined; frontal tubercles indistinguishable; palpi slender, distinctly longer than height of head. Pronotum linear on upper half. Hypopygium as in Figure 1, Plate XXXVI, with three pairs of processes in addition to the lateral arms as in species of *Tanytarsus.* Legs slender; fore tarsi without long hairs; proportions of fore tibiæ and joints of fore tarsi as follows: 46, 65, 44, 34, 28, 10; mid and hind legs with long pale hairs. Third and fourth veins ending respectively about equal distances before and behind apex; cross vein slightly before middle of wing; cubitus forking slightly beyond cross vein.

Length, 5 mm.

Type locality, Delavan Lake, Wis., September 9, 1892 (C. A. Hart).

This species very closely resembles certain species in the genus *Tanytarsus,* especially *obediens* and its allies, and this is particularly noticeable in the structure of the hypopygium, which is quite similar in form to that of most of the species of *Tanytarsus.* I have been unable to distinguish on the wings of the type specimen any surface hairs whatever, and therefore retain it in *Chironomus,* though fresh specimens may ultimately show that it belongs to *Tanytarsus.*

Subsection 2

Fore tarsi with basal joint distinctly more than 1.5 as long as fore tibiæ

43. Chironomus fuscicornis, n. sp.

Male.—Blackish brown, shining. Head dark brown, face yellowish; antennæ fuscous; basal joint of flagellum yellow, plumes fuscous; palpi dark brown. Thorax glossy brown, yellowish between the vittæ and on posterior half between the lateral vittæ except a small triangular area in front of scutellum which is usually connected with the median vitta by a fine line; the pale portions with light pruinescence. Posterior margins of abdominal segments 1–5 pale yellowish, the pale color generally carried forward some distance on the lateral margins; apical portion of lateral arms of hypopygium yellowish. Legs yellow, mid and hind coxæ slightly brownish, fore tibiæ, fore tarsi, and apices of mid and hind tarsi tawny; the usual black comb at apices of mid and hind tibiæ. Wings clear, veins yellow, cross vein not infuscated. Halteres yellow.

Frontal tubercles absent; apical palpal joint longest, relative proportions of the apical three joints as follows: 65, 40, 45. Pronotum

distinct, though linear above, extending nearly to upper margin of mesonotum. Hypopygium as in Figure 10, Plate XXXIV. Fore tarsi without long hairs; basal joint more than half as long again as fore tibiæ (80: 50); mid and hind legs with very long hairs. Third vein ends as far in front of apex of wing as fourth does behind same; cubitus forking slightly beyond cross vein; first and third veins very hairy.

Female.—Differs from the male in being darker, in having the antennæ yellow, the abdomen with narrow pale margins to all the segments, and in having the halteres yellowish brown.

The mid and hind legs have the hairs much shorter than those of the male.

Length, 4.5–5 mm.

Type locality, Havana, Ill., June 15, 1914. Taken by the writer upon laboratory of the Biological Station. Paratypes from Berrien Springs, Mich., July 16, 1914 (C. A. Hart), and Plummer's Island, Md., July–August, 1912 (W. L. McAtee)—the latter in collection of the U. S. Bureau of Biological Survey, Washington, D. C.

44. Chironomus halteralis Coquillett

Chironomus halteralis Coquillett, Ent. News, Vol. 12, 1901, p. 17.

Male.—Shining blackish brown or black. Head, including antennæ and their plumes, fuscous. Ground color of thorax rather variable, varying from pale brown with dark brown vittæ to dark brown with black vittæ, the spaces between vittæ grayish pruinescent; scutellum varying from dull yellow to brown. Abdomen entirely black, Legs yellow, mid and hind coxæ brownish, bases of fore and mid femora sometimes faintly brownish. Wings clear, veins yellow, cross vein not infuscated. Halteres yellow, knob black. Hairs on body and legs yellow.

Frontal tubercles absent. Pronotum linear on upper half. Hypopygium as in Figure 15, Plate XXXIV. Fore tarsi without long hairs, basal joint nearly twice as long as fore tibiæ (40: 22). Cubitus forking distinctly but not greatly beyond cross vein.

Female.—Agrees with the male in color.

Length, 2–3 mm.

Illinois localities: Spoon River, near Havana, September 16, 1895 (C. A. Hart); Urbana, September 5, at light, Monticello, June 21 and 28, and Muncie, May 24, 1914 (C. A. Hart and J. R. Malloch).

Originally described from Washington, D. C., and subsequently recorded from Ithaca, N. Y. I have seen specimens from Plummer's

Island, Md. (May, July, and August), from Currituck, N. C. (September 9), and from Graham Mountain, Ariz. (May, 1914), all in the collection of the U. S. Bureau of Biological Survey; also specimens from Cedar Lake, Ind., July 17, 1914 (C. A. Hart), and from Wingra Lake, Wis., August 8, 1913, at light (A. C. Burrill).

The early stages are undescribed.

45. Chironomus nitidellus Coquillett

Chironomus nitidellus Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 608.

Male.—Glossy black. Head brownish, face and palpi yellow; scape of antennæ glossy black, flagellum and plumes yellowish brown. Thorax highly glossy, black, disc without traces of pruinescence; scutellum brownish; postnotum glossy black. Abdomen glossy black, yellowish at base; hypopygium brownish. Legs yellow, coxæ, femora except bases, the entire fore tibiæ and narrow apices of mid and hind pairs deep black; tarsi brownish apically, fore pair blackened from before apex of basal joint. Wings clear, veins brown. Halteres whitish.

Frontal tubercles absent; antennæ over 1.5 times as long as head and thorax together; palpi much longer than height of head. Disc of mesonotum almost bare. Hypopygium almost identical with that of *Tanytarsus obediens* (Pl. XXXVI, Fig. 9). Legs slender; fore tarsi bare, basal joint about one fifth longer than fore tibiæ (51 : 40); mid and hind legs with rather short hairs. Third vein ending about as far in front of apex of wing as fourth does behind it; cubitus forking slightly beyond cross vein.

Female.—Agrees in color with male, except that the pale color at base of abdomen is not so noticeable.

Length, 2.5–3 mm.

Locality, Berrien Springs, Mich., July 16, 1914 (C. A. Hart). This species has not been taken in Illinois as far as I am aware, but one may safely assume from its occurrence in the above locality that it very probably occurs in this state.

Originally described from Riverton, N. J., and not subsequently recorded. I have seen specimens, submitted by Mr. Cresson from Swarthmore, Pa., and from Delaware.

46. Chironomus griseus, n. sp.

Male.—Black. Head brown; face yellowish; antennæ fuscous, the plumes silvery gray. Thorax covered with pale gray pruinescence,

opaque. Abdomen slightly shining, the segments slightly gray pruinescent on posterior margins; hypopygium brown. Legs obscurely brownish, darker at apices of femora and at apices and bases of tibiæ; the latter except their extremities and the basal joints of the tarsi whitish yellow. Wings vitreous, veins colorless. Halteres yellow. Hairs on body and legs white.

Apical joint of palpi not longer than the preceding one. Pronotum rather broad throughout its entire length, reaching almost to upper margin of mesonotum. Hypopygium as in Figure 3, Plate XXXVI.

Legs of only moderate length, fore tarsi with long hairs, basal joint about two thirds longer than fore tibiæ (50: 30), mid and hind legs with long hairs. Third and fourth veins ending as in Figure 15, Plate XXXIX, cubitus forking almost directly below cross vein.

Length, 4.5 mm.

Type locality, South Haven, Mich., July 14–15, 1914 (C. A. Hart). One specimen taken at light and another swept from vegetation on the shore of Lake Michigan.

Female and early stages unknown.

47. Chironomus maturus Johannsen

Chironomus maturus Johannsen, Bull. 124, N. Y. State Mus., 1908, p. 279.

Male.—Differs from the preceding species in having the antennal plumes brown, the mesonotum with three shining black vittæ, the scutellum yellowish, the abdominal segments yellow on their apical fourth in addition to the whitish pruinescence, the legs more uniformly brownish yellow, the wings slightly grayish, and the veins brown.

Frontal tubercles distinct; apical joint of palpi distinctly longer than preapical. Pronotum linear on upper half. Hypopygium as in *utahensis*, Figure 6, Plate XXXVIII. Legs long and slender. (The males before me have lost the fore tarsi. See under female.) Third and fourth veins ending as shown in Figure 10, Plate XXXIX; cubitus forking very slightly beyond cross vein.

Female.—Agrees in color with the male. Fore tibiæ and tarsi as in *griseus*, but the basal joint comparatively longer (90: 57). Differs from male in having wings comparatively broader.

Length, 7–8 mm.

Illinois locality, Lilly, on the banks of the Mackinaw River, June 11, 1914 (C. A. Hart).

Originally described from Ithaca, N. Y. I have one specimen of each sex, submitted by Professor Johannsen from the type locality.

Early stages undescribed.

48. Chironomus festivus Say

Chironomus festivus Say, Jour. Acad. Nat. Sci. Phil., Vol. 3, p. 13, sp. 2. 1823.
Chironomus lineatus Say, ibid., p. 14, sp. 5.
Chironomus lineola Wiedemann, Aussereurop. Zweifl. Ins., Vol. 1, 1828, p. 17, sp. 6.

Male.—Bright green, shining. Antennæ and their plumes yellow, flagellum except the base fuscous; palpi and face yellow. Mesonotum with three reddish vittæ; sternopleura and postnotum reddish. Abdomen bright green, the apices of segments 2–6 narrowly blackened on center. Legs reddish yellow. Wings clear, cross vein not infuscated or very slightly so. Body hairs yellow.

Antenna about one and a half times as long as head and thorax together, antepenultimate joint of palpi as long as the next two joints together, ultimate joint slightly shorter than penultimate. Pronotum continuous to upper level of mesonotum, linear on upper half. Thoracic hairs normal. Second segment of abdomen with a slight ridgelike apex; segments 3–5 almost invariably with two small wartlike protuberances in the black portion close to apical margin, one on each side of the median line, and slightly cephalad of these, and much closer together, two small smooth areas which may be sensory organs but have the appearance of hair sockets; sixth segment with a slight central apical callosity; hypopygium (Pl. XXXIII, Fig. 14) with the dorsal process black, glossy, the apical portion of the lateral arm distinctly longer than the basal. Legs rather stout, basal joint of fore tarsi two thirds longer than tibia (105 : 65), outer surface of fore tarsi from middle of basal joint to middle of fourth with very long hairs; mid and hind legs with long surface hairs; apices of mid and hind femora with a brown flattened scalelike process on the anterior surface which projects slightly beyond apex. Wings narrow; cross vein beyond middle of wing; cubitus forking very slightly beyond cross vein.

Female.—Similar to the male in color except that only the apex of the flagellum is fuscous, that there is a blackish brown median line on central portion of the mesonotum in addition to the reddish vittæ, and that the fore tibiæ, fore tarsi from middle of basal joint, and the apices of the other tarsi are brown. The fore tarsi have no long hairs, the apical process on mid and hind femora is rather stouter than in the male, and the abdomen has not wartlike processes at apices of segments.

Length, 8–9 mm.

Illinois localities: St. Joseph, Monticello, Lilly, Kampsville, and Havana, dates ranging from June 2 to August 21.

Say's description of *festivus* gives the length of the female as 7/20 of an inch (9 mm.), but the description is obviously that of a male, since no female has the fore tarsi hairy. With regard to locality he merely says: "Observed particularly in Illinois." *Lineatus* was described from Pennsylvania. The female has been recorded under the name *lincola* as occurring in New Jersey. Mr. Hart captured a large number of specimens, mostly females, at Berrien Springs, Mich., and one female, at light, at Niles, Mich., July 13 and 16, 1914.

Early stages undescribed.

49. Chironomus dorneri, n. sp.

Female.—Yellow, glossy. Head brownish yellow; antennæ yellow; apical joint fuscous; palpi yellow. Mesonotum with the vittæ reddish, a large wedge-shaped mark on median vitta, the sharp extremity of which is directed caudad, and the outer half of each of the lateral vittæ black. Abdomen with basal segment brownish, the remainder missing in type. Legs bright reddish yellow, apices of fore femora, fore tibiæ except an indistinct patch beyond middle, fore tarsi from middle of basal joint, knee-joints of mid and hind legs, and apical two tarsal joints of these legs blackish brown. Wings clear, veins yellow, cross vein darkened. Halteres yellow.

Frontal tubercles absent; antennæ with rather long hairs; palpi longer than antennæ. Pronotum very narrow, linear on upper half. Legs long and slender; basal joint of fore tarsi about two thirds longer than fore tibiæ (102:60), the next three joints subequal in length (40); apical comb of posterior tibiæ produced in center in the form of a spur. Third vein ending as far in front of apex of wing as fourth ends behind it; cubitus forking slightly beyond cross vein.

Length, 5 mm.

Type locality, Brownsville, Texas (G. Dorner).

Named in honor of the collector.

Early stages unknown.

50. Chironomus illinoensis, n. sp.

Male.—Yellowish green. Head yellow; antennæ fuscous with the exception of the scape and basal joint of flagellum, the plumes fuscous; palpi yellow. Mesonotum shining, the vittæ brown, the lateral pair generally distinctly darker than the median one; pleuræ with a brown longitudinal median stripe; scutellum yellow; postnotum brown, yellowish at base. Abdomen more distinctly green than thorax, generally

retaining the color after death; apices of the first six segments distinctly browned or blackened. Legs yellow, the normal black comb at apices of mid and hind tibiæ. Hairs of body and legs yellow.

Frons without tubercles. Pronotum of moderate breadth on lower portion, tapering rapidly and becoming obsolete some distance from the upper margin of mesonotum. Hairs on mesonotum of moderate length, rather sparse. Abdomen with long hairs; hypopygium as in Figure 1, Plate XXXIV. Fore tarsi with short hairs, those on posterior surface of third joint, and occasionally a few at apex of second, very distinctly longer than the diameter of these joints; basal joint one and two thirds times as long as tibia (45 : 27); mid and hind legs with long hairs. Third vein ends almost at wing-tip; cross vein not darker, or very slightly so, than other veins; cubitus forking beyond cross vein.

Female.—Differs from the male in having the flagellum slightly paler, and the apices of the abdominal segments without black.

The proportions of the fore tibia and basal joint of the fore tarsus are the same as in the male, but the long hairs are absent. The wings are broader and the cubitus forks much farther distad of the cross vein.

Length, 2.5–3.5 mm.

Type locality, Carbondale, Ill. Taken by sweeping vegetation along bank of creek April 23, 1914 (C. A. Hart and J. R. Malloch). A single female was taken in the railroad depot at Golconda, Ill., April 19, 1914.

Var. *decoloratus,* n. var.

This variety differs from the type in color.

The mesonotum has but faint indications of vittæ, and the apices of the abdominal segments are very indistinctly darker than the remainder of the segments, while the ground color throughout is yellow instead of green, and the wing veins are pale yellow.

Type locality, Spoon River, near Havana, September, 19, 1895 (C. A. Hart).

This may be a seasonal variety of somewhat similar nature to the summer form of *tentans.*

—— 51. Chironomus decorus Johannsen

Chironomus decorus, Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 239.

Larva.—Length, 10–12 mm. Blood-red. Head pale brown, apices of mandibles and labial plate black; eye spot duplicated, distinctly sep-

arated; labial plate as in *tentans?* (Pl. XXIX, Fig. 9); ventral blood-gills on eleventh segment, very long, four in number.

Pupa.—Length, 7–8 mm. Reddish. Frontal tubercles large (Pl. XXXI, Fig. 12). Thoracic respiratory organs white, consisting of numerous hairlike filaments. Abdominal segments with the dorsum covered with minute setæ except on lateral and anterior margins and on the apical half of the median line, the setæ on apical two segments indistinct; lateral apical process of eighth segment as in Figure 3, Plate XXXI.

Imago; Male.—Greenish yellow, subopaque. Head yellow, antennæ fuscous, scape and base of flagellum sometimes yellowish, plumes bicolored, brown at base and on a space before apex, on the intervening space and on apex yellow; palpi fuscous. Mesonotum with whitish pruinescence, most distinct between vittæ, the vittæ reddish; lower half of sternopleura, a patch below wing-base, and postnotum reddish. Abdomen green or greenish yellow, each segment with a narrow transverse median brown band which rarely extends to the anterior margin. Legs yellow, apices of tibiæ and of tarsal joints narrowly brownish. Wings clear, veins yellow, cross vein infuscated; posterior branch of cubitus slightly infuscated.

Frontal tubercles of moderate size. Hypopygium as in Figure 11, Plate XXXIII. Fore tarsi bare, basal joint distinctly more than one half longer than fore tibiæ (80: 52); mid and hind legs with long hairs. Venation as in *scrus.*

Female.—Agrees with the male in color except that the abdominal bands are generally broader and extend closer to the anterior margins of the segments.

Length, 5.5–7 mm.

Illinois localities: Illinois River for a considerable distance north and south of Havana; Urbana, St. Joseph, Dubois, and Mt. Carmel, on various dates in the months of April, May, June, September, and October. This species often occurs at light. The larvæ occur almost as commonly in the Illinois River as do those of *viridicollis.* They also occur almost everywhere in streams and ponds, and commonly pass through the pipes conveying the household water-supply in cities where the reservoirs are unprotected, as mentioned under *viridicollis,* the appearance of the "blood-worms" often causing unnecessary alarm. Probably the commonest species of the genus.

Originally described by Johannsen from material representing the following states: New York, Ohio, Illinois, Iowa, Kansas, Washington, and Nebraska.

52. Chironomus flavus Johannsen

Chironomus flavus Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 225.

Larva.—Johannsen describes the larva as being 6 to 7 mm. in length, pale yellowish green, head brown. The labium is as in Figure 4, Plate XXIX, which is reproduced from Johannsen's figure.

Pupa.—Johannsen's description of the pupa gives the length as 3.5 to 4 mm. and the color as pale yellow with yellowish brown thorax. The thoracic respiratory organs are of the normal form in this genus. Abdominal segments 2–5 have each a transverse band of short setæ near the anterior margin and the disc covered with similar, smaller setæ enclosing several small circular clear spaces; the lateral fin of the eighth segment "has the usual filaments, each fin terminating in a toothed process, deep brown in color."

Imago; Male.—Similar to *fulvus*. Differs in being much paler, the abdomen and legs being entirely pale yellow. The fore tarsi differ from those of *fulvus* in having the second joint distinctly longer than the fore tibiæ. In freshly emerged specimens of *flavus* and *fulvus* the long hairs on the fore tarsi are readily seen, but in specimens that have been on the wing for some time, or have been handled much, the hairs are usually seen with difficulty or are entirely absent. The hypopygium is as in Figure 14, Plate XXXIV.

Female.—Similar to the male in color and in comparative lengths of fore tibiæ and tarsi.

Length, 2.5–3.5 mm.

Illinois localities: Havana, June; Muncie, May 24; Monticello, June 24; Urbana, June 18 and September 5; Momence, July 17,—all in 1914. Momence and Urbana specimens taken at light, the others swept from vegetation on the banks of rivers (C. A. Hart and J. R. Malloch).

Originally described from Ithaca, N. Y. Specimens from the type locality have been furnished me by Professor Johannsen.

53. Chironomus curtilamellatus, n. sp.

Male.—Pale yellowish green, subopaque. Head yellow; scape of antennæ reddish yellow, flagellum pale brown, plumes brownish at apices, yellowish at bases. Mesonotum with faint indications of reddish vittæ, pleural spots and postnotum reddish yellow. Abdomen slightly browned on apical three segments. Legs pale yellow, fore tibiæ and tarsi and apices of mid and hind tibiæ slightly browned; mid and hind tibiæ with brown apical comb. Wings clear, veins yellow,

cross vein not infuscated. Halteres pale yellow. Hairs on body and legs pale yellow.

Antenna not much longer than head and thorax combined. Pronotum linear. Hypopygium with only a poorly developed inferior process on inner surface of basal portion of lateral arm (Pl. XL, Fig. 2). Legs slender; fore tarsi without long hairs, basal joint twice as long as fore tibiæ, proportions of fore tibiæ and first and second tarsal joints as 19, 40, and 22; mid and hind legs with rather short hairs; pulvilli and empodia large. Third vein ending but little farther in front of apex of wing than fourth does behind it; cubitus forking very slightly beyond cross vein, the latter situated a little before wing-middle.

Length, 3 mm.

Type locality, South Haven, Mich., July 15, 1914, at light (C. A. Hart).

This species closely resembles *flavus,* but differs in proportions of basal joint of fore tarsi and in the form of the hypopygium.

The female and early stages are unknown.

54. Chironomus tenuicaudatus, n. sp.

Male.—Agrees in color with *modestus.* Differs noticeably from both *modestus* and *indistinctus* in the structure of the hypopygium, which is shown in Figure 12, Plate XXXIII. In other respects agrees with *modestus.*

Length, 3.5–4 mm.

Type locality, Havana, Ill., April 27–28, 1914 (C. A. Hart and J. R. Malloch). Paratypes, 1914, St. Joseph, May 3, and Urbana, May 19, 20. Taken by the same collectors.

This may be the species designated by Johannsen as variety *b* of *modestus**. If so, the pupa differs from that of *indistinctus* in having the lateral teeth absent from apex of eighth segment, while in other respects agreeing with that species.

The early stages are unknown to me.

55. Chironomus neomodestus, n. sp.

This species differs from *indistinctus* in having the thorax opaque brownish yellow with blackish gray vittæ and very distinct gray pruinescence. The abdomen is fuscous. Otherwise as *indistinctus.*

*Aquatic Nematocerous Diptera, Bull. 86, N. Y. State Mus., 1905, p. 228.

The hypopygium resembles that of *modestus* in having the superior process much dilated apically, though the inferior process is almost identical with that of *indistinctus*.

Length, 3–4 mm.

Type locality, St. Joseph, Ill., May 3, 1914.

This species may readily be separated from *modestus* and its allies by the characters mentioned above, and from the other species in Subsection 2 by the furcate inferior hypopygial process.

The early stages are unknown to me.

56. Chironomus modestus Say

Chironomus modestus Say, Jour. Acad. Nat. Sci. Phil., Vol. 3, 1823, p. 13, sp. 3.

Larva.—Length, 6–7 mm. Yellowish. Antennæ slender, basal joint distinctly longer than the apical four joints together, second joint as long as third and fourth; labium with middle tooth undivided and distinctly stouter than the first lateral; mandibles of the usual form, with three teeth on ventral surface in addition to the long apical tooth.

Pupa.—Length 5–5.5 mm. Green. Thoracic respiratory organs terminating in the usual white hairlike filaments. Second abdominal segment with the normal apical transverse row of setulæ, the posterior two thirds of the surface with numerous short setulæ which do not extend to the lateral margins apically and gradually recede from them towards base of segment; segments 3–6 with a similar discal patch, enclosed in which are several rather indistinct rounded bare spots, and in addition to the large patch and between it and bases of these segments there are two transversely elongate groups of setulæ which in some specimens unite on median line, forming a complete transverse bar (Pl. XXXI, Fig. 10); apical lateral process of eighth segment as in Figure 17, Plate XXXI.

Imago; Male.—Grass-green, slightly shining. Head yellowish green; scape of antennæ yellow, flagellum fuscous, the plumes brownish. Mesonotum with pale reddish or yellowish vittæ; sternopleura, mesopleura, and postnotum largely reddish or reddish yellow. Abdomen bright green, rarely darkened apically. Legs greenish or yellowish, fore knees, narrow apices of fore tibiæ, the whole of fore tarsi from middle of the basal joint, and mid and hind tarsi from apex of third joint to tips brown; mid and hind tibiæ with the normal black apical comb. Wings clear, veins yellow. Halteres yellow, green apically.

Frontal tubercles indistinguishable. Pronotum rather broad, continued almost to upper margin of disc. Hypopygium as in Figure 8,

Plate XXXIV. Legs slender; fore tarsi bare, the basal joint two thirds longer than the fore tibiæ (50:30); mid and hind legs rather long, but not densely haired. Third vein ends as far before apex of wing as fourth does behind it; cubitus forks very slightly beyond cross vein.

Length, 4.5 mm.

Illinois localities: Havana, April 28 to May 2, St. Joseph, May 3, and Dubois, April 24, 1914 (C. A. Hart and J. R. Malloch).

Originally described by Say from Pennsylvania, and subsequently recorded from New York and New Jersey. I have seen a specimen, in rather poor condition, from Attica, Ind., July 12, 1914 (C. A. Hart).

57. Chironomus indistinctus, n. sp.

Larva.—Undescribed. Color given as reddish by Johannsen.

Pupa.—Length, .3 mm. Greenish or yellowish. Transverse row of setulæ at apex of second segment not extending to lateral margins, the setulæ rather large and pale; segments 3–6 with two approximated pear-shaped groups of short setulæ as in Figure 13, Plate XXXI, lateral posterior process of eighth segment as in Figure 14.

Imago; Male.—Darker than *modestus,* the thoracic vittæ and postnotum usually reddish, the abdomen often dark green or even fuscous, the fore knees usually brownish, and the apices of fore tibiæ, of the basal two tarsal joints, and the last three tarsal joints entirely, brown. The cross vein of the wing is clear.

Basal joint of fore tarsi two thirds longer than fore tibiæ. Hypopygium similar in general appearance to that of *modestus,* differing principally in having the apical portion of the lateral arm more slender, the superior process much less dilated at apex (Pl. XXXIV, Fig. 6), and the inferior process more rounded (Fig. 7).

Female.—Agrees in color with the male except that the abdomen is generally paler.

Length, 2.5–3 mm.

Type locality, St. Joseph, Ill., May 3. Swept from vegetation along the bank of Salt Fork by Mr. Hart and the writer. Paratypes from Havana, the same collectors, all in 1914.

Pupæ were obtained by the writer from Thompson's Lake, near Havana, April 27, 1914.

This is the species that Johannsen described briefly from New York as variety *a* of *modestus.* He indicated that while the imagines are very closely related the larvæ and pupæ are much more distinct

from each other. He does not describe the larva beyond stating that the color is reddish.

58. Chironomus fulvus Johannsen

Chironomus fulvus Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 224.

Below, is Johannsen's description of a pupa supposed to be of this species.

Pupa.—"This pupa had very much elongated respiratory organs, nearly as long as the body, the main trunk flattened, slender, diminishing in diameter toward the end, the apical end subdivided into three or four branches. Each abdominal segment with a transverse row of rather conspicuous spines near the posterior margin, and a number of long setae, three or four pairs of which are laterals, one or two pairs discals, and a marginal pair. . . . The lateral fin of the eighth segment is provided with a somewhat sinuous yellow spur a little caudad of the middle. The caudal fin is fringed with the usual flattened matted filaments, those more caudad being longer and broader than the others."

Imago; Male.—Greenish yellow. Head yellow, flagellum of antennæ fuscous except at base, the plumes yellow. Mesonotum with fulvous vittæ; scutellum greenish yellow; postnotum fulvous. Abdomen green, becoming gradually infuscated from before middle to apex. Legs greenish yellow; fore tibiæ and tarsi brownish, the former usually paler on middle; apices of mid and hind tarsi brownish. Wings clear, veins yellow, cross vein not infuscated or very slightly so. Hairs on body and legs yellow.

Frontal tubercles indistinguishable. Pronotum linear on upper half. Hypopygium as in Figure 16, Plate XXXIV. Fore tarsi with rather sparse long hairs, basal joint about one and three fourths as long as fore tibiæ (60: 35), cubitus forking almost directly below the cross vein.

Female.—Fulvous. Abdomen yellow, generally without any indication of green. Legs colored as in the male, but the brown more intense and the fore tibia generally entirely brown.

Length, 3.5–4.5 mm.

Illinois localities: various places near Havana on the Illinois and Spoon rivers; St. Joseph, Monticello, Urbana, and Muncie (C. A. Hart and J. R. Malloch). Dates of occurrence range from April 23 to September 18; occasionally taken at light.

Originally described from the female only, obtained at Ithaca, N. Y. I have before me two female specimens from the type locality, submitted by Professor Johannsen. I have seen specimens from Niles

and South Haven, Mich., July 13 and 14, and from Cedar Lake, Ind., July 17, 1914 (C. A. Hart).

The description of the pupa of this species agrees fairly well with that of *Chironomus* species C, given on page 529 of the present paper, differing as indicated in notes under that species.

59. Chironomus parvilamellatus, n. sp.

Male.—Greenish yellow, slightly shining. Head yellowish, scape of antennæ black, shining, flagellum pale brown, plumes yellowish. Mesonotum with dark brown vittæ, the whole disc covered with slight grayish pruinescence; scutellum yellow; pleural spots and postnotum dark brown. Abdomen green, almost entirely suffused with fuscous. Legs greenish yellow, fore legs with the exception of the femora brownish, becoming darker on tarsi, apices of mid and hind tarsi browned. Wings clear, veins yellowish, cross vein very indistinctly infuscated. Halteres yellow.

Antenna more than 1.5 times as long as head and thorax together. Pronotum narrow, central excision indistinct. Hypopygium almost the same as that of *abbreviatus* (Pl. XXXIV, Fig. 18), the apical portion of the lateral arm comparatively shorter and stouter. Legs slender, fore tarsi without long hairs, basal joint very slightly more than 1.5 times as long as fore tibiæ (57 : 36); mid and hind legs with moderately long hairs; pulvilli and empodia distinct. Third vein ending very slightly farther in front of apex of wing than fourth does behind it; cubitus forking distinctly, but not greatly, beyond cross vein.

Length, 4.5–5.5 mm.

Type locality, Grand Tower, Ill., April 22, 1914, swept from vegetation on bank of Big Muddy River (C. A. Hart and J. R. Malloch).

This species bears a close resemblance to *abbreviatus* and *fulvus*, but from the former it may be distinguished by its color and the absence of long hairs from the fore tarsi, and from *fulvus* as indicated in key. It differs from Johannsen's description of *dux* in having the basal joint of fore tarsi one half longer than fore tibiæ instead of about a third longer, the latter being the proportion given for *dux*.

60. Chironomus obscuratus, n. sp.

Male.—Bright green, slightly shining. Head green; scape of antennæ yellow, flagellum fuscous, yellow at base, plumes brown, yellowish white at bases; palpi green, brownish apically. Mesonotum with reddish yellow vittæ; spots on sternopleura and below wing-base, and the postnotum concolorous with vittæ. Abdomen yellowish at apex,

including the hypopygium. Legs green, tibiæ and tarsi yellowish, fore tibiæ and tarsi and apices of mid and hind tarsi brownish. Wings clear, veins yellowish, cross vein not darkened. Halteres green or yellowish.

Frontal tubercles absent. Pronotum narrow. Hypopygium as in Figure 5, Plate XXXIV. Legs slender; fore tarsi without long hairs, basal joint about three fourths longer than fore tibiæ (78: 45), second joint one eighth shorter than tibiæ (40); mid and hind legs with moderately long hairs, their tibiæ with the apical combs produced into two points, each point armed with a spur. Third and fourth veins ending respectively at about the same distance before and behind apex of wing; cubitus forking distinctly, but not greatly, beyond cross vein.

Female.—Agrees in color with the male except that the fore tibiæ and tarsi are more distinctly browned.

Length, 5–6 mm.

Type locality, Dubois, Ill., April 24, 1914 (C. A. Hart and J. R. Malloch). Paratype from Lilly, Ill., June 11, 1914 (C. A. Hart).

61. Chironomus incognitus, n. sp.

Male.—Greenish yellow, opaque. Head yellow; scape of antennæ shining black, flagellum pale brown, yellowish at base, plumes yellowish brown; palpi fuscous. Thorax yellow; vittæ, the greater part of sternopleura, a spot below wing-base, and the postnotum grayish black; disc of mesonotum, including the vittæ, covered with rather dense yellowish gray pruinescence. Abdomen green, much suffused with fuscous. Legs yellow, apices of fore femora and bases of fore tibiæ slightly suffused with brown, apices of all tibiæ narrowly brown, apices of tarsi slightly browned. Wings clear, veins brown, cross vein slightly infuscated. Hairs on legs yellow.

Antenna over 1.5 times as long as head and thorax together; palpi slightly longer than height of head. Pronotum linear. Hypopygium as in Figure 1, Plate XL. Legs long and slender; fore tarsi with long sparse hairs on posterior surfaces of second and third joints; basal joint more than 1.5 times as long as fore tibiæ (54: 34); second joint slightly longer than third; mid and hind legs with moderately long, sparse hairs; pulvilli and empodia large, the latter narrowly fringed. Third and fourth veins ending respectively at about equal distances before and behind apex of wing; cubitus forking below cross vein.

Length, 4.5 mm.

Type locality, Muncie, Ill., May 24, 1914, swept from vegetation on bank of Stony Creek (C. A. Hart and J. R. Malloch).

This species differs from *prasinus* Meigen, a European species recorded from North America, in having the basal joint of the fore tarsi more than 1.5 times as long as the fore tibiæ; in *prasinus* it is said to be about 1.25 times longer.

Early stages and female unknown.

62. Chironomus similis Johannsen

Chironomus similis Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 236.

I have not seen the male of this speices, and refer to it only one female, which differs from *serus* in being smaller, 3 mm., and in having the fore tarsi less distinctly elongated, the basal joint being about one and two thirds times as long as the fore tibiæ.

Illinois localities: Chicago (Johannsen), and Dubois, April 24, 1914 (C. A. Hart and J. R. Malloch).

The early stages are undescribed.

Professor Johannsen informs me that the type specimen of *similis* has been destroyed and that he has no other available for comparison. In this case the female described herewith may be accepted as the neotype.

63. Chironomus cristatus Fabricius

Chironomus cristatus Fabricius, Syst. Antl., 1805, p. 39.

This species resembles *decorus* in coloration and size, differing in having the antennal plumes unicolorous, the vittæ brown, and the abdomen with broad brown fasciæ on the segments, which reach to base of each and are produced posteriorly slightly along the median line. The legs are much more distinctly marked with brown, the knees, and especially the bases of the fore tibiæ being noticeably browned. The basal joint of the fore tarsi is much more than one half longer than fore tibiæ (87 : 55). In other respects as *decorus*.

Length, 7–8 mm.

Illinois locality, Easton, May 1, 1914 (C. A. Hart and J. R. Malloch).

Johannsen has recorded this species from the following states: New York, Illinois, Washington, Kansas, Idaho, South Dakota, and New Jersey.

The early stages are undescribed.

64. Chironomus serus, n. sp.

Male.—Yellowish green, opaque. Head yellow, antennæ fuscous, base of flagellum yellow, plumes bicolored, sometimes forming dis-

tinct annuli as in *decorus;* palpi fuscous. Mesonotum with pale pruinescence, which gives it a whitish bloom, especially between the vittæ; vittæ deep brown; sternopleura and a patch below wing-base deep brown; postnotum blackish. Abdomen brownish black, posterolateral angles of segments yellow; all segments with the apical third whitish pruinescent. Legs greenish yellow, knees, almost the entire fore tibiæ, apices of mid and hind tibiæ, and apices of tarsal joints blackened. Wings clear, cross vein infuscated. Halteres yellow, sometimes blackened at apices.

Frontal tubercles small but distinct. Hypopygium similar to that of *decorus* (Fig. 11, Pl. XXXIII). Fore legs with the tarsi very long and slender, proportions of fore tibiæ and fore tarsal joints as follows: 51, 92, 47, 41, 38, 17; fore tarsi bare; mid and hind legs with long hairs. Third and fourth veins ending about equal distances from apex of wing; cubitus forking below cross vein.

Female.—Agrees with male in color.

Fore legs nearly 10 mm. in length, proportions of fore tibiæ and fore tarsal joints as follows: 55, 102, 53, 50, 50, 20; mid and hind legs short-haired. Cubitus forking slightly beyond cross vein.

Length, 5–6.5 mm.

Type locality, Urbana, Ill., September 27 and October 2, 1914, at light and on windows (C. A. Hart and J. R. Malloch). Paratypes from Havana, September 13, 1895, at light (C. A. Hart), and from Urbana, May 3 and 22, and October 3 (C. A. Hart and J. R. Malloch).

Females of this species were observed feeding upon fly-specks on a store window in Urbana, having been attracted to the window by light.

65. Chironomus alboviridis, n. sp.

Female.—Green, opaque. Head, with the exception of the black eyes, center of face, and the apical joint of antennæ, entirely yellow. Thorax pale green; the vittæ, a spot below wing-base, and the greater part of sternopleura reddish, the entire surface, with the exception of the red portions, covered with dense whitish pruinescence; scutellum pale green; postnotum yellowish at base, gradually blackened towards apex. Abdomen dark green, apices of segments paler. Legs pale yellow; fore femora and tibiæ brown; apices of basal two and whole of apical three tarsal joints of fore legs, apices of tibiæ, apices of basal three and the whole of apical two joints of tarsi of mid and hind legs blackish brown. Wings whitish, veins vitreous, apices of veins 1 and 3 yellow. Halteres greenish yellow. Hairs on body and legs white.

Frontal tubercles absent. Pronotum of moderate width, extending nearly to upper margin of mesonotum. Legs slender; fore tarsi with basal joint nearly twice as long as fore tibiæ (57 : 29), second joint a fourth longer than third (25 : 20). Third vein ends but little farther in front of apex of wing than fourth does behind it; cross vein slightly in front of wing-middle; fork of cubitus almost at middle of wing.

Length, 3 mm.

Type locality, Urbana, Ill., July 6, 1914, at light (C. A. Hart and J. R. Malloch).

Early stages and male unknown.

66. Chironomus digitatus, n. sp.

Larva.—Length, 9–10 mm. Blood-red. Head slightly longer than broad; antenna short and inconspicuous, generally widely divergent and at almost right angles to the long axis of head, apical jointed portion missing from type; maxillary palpi about as long as antennæ and projecting similarly; lateral arm of labrum as in Figure 8, Plate XXIII; labium with the middle third pale yellow, the third on each side dark brown-black, shape as in Figure 13, Plate XXX; mandibles as in Figure 12. Anterior pseudopods as in other species of *Chironomus,* the posterior pair with apical claws; dorsal respiratory organs present; eleventh segment without ventral respiratory organs; dorsal papillæ short, with about twelve sensory hairs.

Pupa.—Length, 10 mm. Reddish brown. Frontal tubercles acute and of moderate size, similar to that shown in Figure 1, Plate XXXI; thoracic respiratory organs ending in many white hairlike filaments; immediately posterior to base of respiratory organs is an elongated protuberance, which is but slightly tapering apically and three times as long as its basal diameter; posterior to the foregoing and a short distance in front of base of wing is a short diagonal ridge, which has at its lower, anterior extremity a blunt tubercle slightly longer than its basal diameter, and at its upper, posterior extremity a similar, much shorter, wartlike tubercle; disc of thorax with a few weak hairs and closely placed scalelike setulæ. On middle of first abdominal segment is a transverse row of short brown thorns similar to that shown in Figure 9, Plate XXXI, surface of all segments finely honeycombed (Fig. 15, *a*); segments 2–7 with a preapical strip of setulæ (Fig. 15, *b, c, d*) which become less curved and weaker successively towards seventh segment; second segment with the normal apical transverse row of blackish brown setulæ, the row widely interrupted medianly (Fig. 9); lateral margins of seg-

ments with a few widely spaced, weak, dark hairs, which become more numerous, broader, and paler on apical two segments; no lateral apical thorns on eighth segment; ventral surface of last segment of female as in Figure 5, Plate XXXI.

Imago; Female.—Green. Head yellowish green, last joint of antennæ and the palpi brown. Thorax colored as in *festivus* except that the black median line is not present. Abdomen greenish yellow, the dorsal surface brownish on basal half of each segment. Legs yellow; mid and hind tibiæ with a black apical comb; apices of first two tarsal joints and the remaining joints on all legs brownish. Wings clear, veins yellow, cross vein brownish. All hairs on body and legs yellow.

Antenna about half as long as thorax, basal joint slightly enlarged, globose, apical joint slender, as long as the preceding two joints combined; length of palpi about equal to that of antennæ. Thorax similar to that of *festivus*. Abdomen in type in poor condition. Legs stout; hairs short; basal joint of fore tarsus more than 1.5 times as long as fore tibia (70:43). Wings with cubitus forked below the cross vein.

Length, 5 mm.

Type locality, Thompson's Lake, Havana, Ill., May, 1914 (C. A. Hart and J. R. Malloch). Reared from larvæ taken by dredging in eight and a half feet of water. Paratypes from Havana, May 4, 1895, flying over surface of Illinois River (C. A. Hart).

There are very many examples of the larvæ of this species in the Laboratory collection which were taken by dredging in various parts of the Illinois River during 1913.

A larva which is similar to the one here described and also to that of *Chironomus* sp. C (p. 529) is figured and described from Lake Leman, in Switzerland, by Mlle. A. Zebrowska in her thesis* presented for the degree of D. Sc. In this paper she refers to the species as *Orthocladius* B, and no reference is made to the imago. The peculiar labial plate of these species is so different from that of any known species of *Chironomus* that I had in my preliminary work simply designated them as "Genus?", and it was a surprise to me when what appears to be a typical *Chironomus* much resembling *viridis* emerged from the pupa described above.

Tanytarsus Van der Wulp

The larvæ of species of this genus are not sufficiently well known to warrant the use of any particular character for their generic sepa-

*Recherches sur les Larves de Chironomides du Lac Léman. Lausanne, 1914.

ration from those of *Chironomus* and allied genera, and in this paper I have included all of them in a single key. Some, probably not all of them, construct cases (see Pl. XXXII, Fig. 5), but while this fact is of considerable biological significance, it is obviously valueless as a character for systematic arrangement unless the case is preserved along with the larva.

The pupæ of such species as are known to the writer have elongate unbranched thoracic respiratory organs and the abdominal segments with conspicuous groups of setulæ on the dorsum.

The imagines are distinguished from *Chironomus* by the presence of hairs on the wings, and from other genera in *Chironominæ* by the elongated basal joint of the fore tarsi, which is longer than the fore tibiæ. The structure of the hypopygium is not unlike that of most species in *Chironomus* but quite distinct from that of *Cricotopus, Orthocladius,* and *Metriocnemus.* In *Tanytarsus* and *Orthocladius* the third vein usually ends appreciably farther from apex of wing than does the fourth, while in *Chironomus* these veins end respectively at about equal distances before and behind the apex. Only in a very few species in *Chironomus* is there a departure from this rule, but these exceptions are sufficient to cause me to refrain from regarding this character in *Tanytarsus* as being of generic value.

Key to Species in Laboratory Collection

1. Males 2
— Females 16
2. Fore tarsi with long hairs 3
— Fore tarsi without long hairs, those that are present barely longer than the diameter of the tarsal joints 4
3. Basal joint of fore tarsi about one seventh longer than fore tibiæ (40 : 35) ; black species, legs fuscous; hypopygium as in Figure 2, Plate XXXVI ..... 1. *nigripilus.*
— Basal joint of fore tarsi nearly one half longer than tibiæ (63 : 44) ; legs pale brown; hypopygium as in Figure 6, Plate XXXVI .... 2. *dives.*
4. Basal joint of fore tarsi at least twice as long as fore tibiæ 5
— Basal joint of fore tarsi at most slightly more than half as long again as fore tibiæ 9
5. Basal joint of fore tarsi about two and a half times as long as fore tibia (24 : 63) 6
— Basal joint of fore tarsi about twice as long as fore tibia 8
6. Second joint of fore tarsi very slightly longer than fore tibiæ (25 : 24) ..... 3. *neoflavellus.*
— Second joint of fore tarsi at least one fourth longer than fore tibiæ 7

7. Small species, 1.5 mm.–1.75 mm. ..... 4. *flavellus.*
— Larger species, 3–3.5 mm. ..... 5. *confusus.*
8. Scape of antennæ black, base of flagellum yellow, the remainder pale brown; thoracic vittæ, lower half of pleuræ, the scutellum, and postnotum greenish black, contrasting strikingly with the whitish green abdomen ..... 6. *pusio.*
— Scape of antennæ yellow; thoracic vittæ pale ferruginous or indistinguishable; thorax and abdomen yellow or greenish yellow ..... 7. *tenuis.*
9. Thorax entirely black, wholly or partly glossy; legs entirely pale yellow 10
— Thorax yellow or greenish, the spaces between the vittæ always noticeably paler than the vittæ; or legs brownish 12
10. Small species, 2.5–3 mm. in length; abdomen pale green; basal joint of fore tarsi more than one half longer than fore tibiæ; hypopygium as in Figure 8, Plate XXXVI ..... 8. *viridiventris.*
— Larger species, more than 4 mm. in length; abdomen black, with or without pale posterior margins to the segments; basal joint of fore tarsi less than a fourth longer than fore tibiæ 11
11. Abdomen usually with yellow posterior margins to the segments; apical portion of lateral arm of hypopygium black or blackish brown and not as long as basal portion ..... 9. *obediens.*
— Abdomen entirely black except the apical portion of lateral arm of hypopygium, which is yellow and noticeably longer than basal portion ..... 10. *flavicauda.*
12. Basal joint of fore tarsi less than one half longer than fore tibiæ 13
— Basal joint of fore tarsi more than one half longer than fore tibiæ 15
13. Basal joint of fore tarsi nearly one half longer than fore tibiæ (48:33) ..... 11. *politus.*
— Basal joint of fore tarsi at most one fourth longer than fore tibiæ 14
14. Thorax yellowish, vittæ brown; abdomen green; proportions of fore tibia and basal joint of fore tarsi, 20:25 ..... 12. *muticus.*
— Thorax brown, vittæ glossy black; abdomen black; proportions of fore tibia and basal joint of fore tarsi, 35:42 ..... 13. *similatus.*
15. Small species, averaging 2 mm. in length; distance from base of first vein to cross vein about half as long as distance from cross vein to apex of wing (20:41) ..... 14. *exiguus.*
— Larger species, averaging 3 mm.; distance from base of first vein to cross vein distinctly more than half as long as distance from cross vein to apex (35:50) ..... 15. *dubius.*
16. Thorax and abdomen black 17
— Thorax and abdomen yellow or greenish, the former sometimes with dark vittæ 20

17. Legs fuscous or brownish.....18
— Legs yellowish or whitish.....19
18. Basal joint of fore tarsi about one seventh longer than fore tibiæ .....1. *nigripilus.*
— Basal joint of fore tarsi nearly one half longer than fore tibiæ.... .....2. *dives.*
19. Abdominal segments with pale posterior margins..... .....9. *obediens.*
— Abdominal segments without pale posterior margins..... .....10. *flavicauda.*
20. Basal joint of fore tarsi at least twice as long as fore tibiæ.....21
— Basal joint of fore tarsi less than twice as long as fore tibiæ.....23
21. Basal joint of fore tarsi twice as long as fore tibiæ; mesonotum with distinct vittæ.....6. *pusio.*
— Basal joint of fore tarsi distinctly more than twice as long as fore tibiæ; mesonotum without vittæ.....22
22. Larger species, more than 2.5 mm. in length.....3. *neoflavellus.*
— Small species, 1.5–2 mm. in length.....4. *flavellus.*
23. Basal joint of fore tarsi less than one half longer than fore tibiæ.... .....See 13
— Basal joint of fore tarsi more than one half longer than fore tibiæ.. .....See 15

1. Tanytarsus nigripilus Johannsen

Tanytarsus nigripilus Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 287.

Male.—Black, slightly shining. Tibiæ, tarsi, and knobs of halteres brown-black. Wings clear, veins brown.

Antepenultimate joint of palpi almost as long as the next two joints together. Pronotum narrow, not continued to upper margin of mesonotum. Hypopygium as in Figure 2, Plate XXXVI. Legs slender; fore tarsi with long hairs, basal joint about one sixth longer than fore tibiæ (38: 32); mid and hind legs with long hairs. Third vein ending distinctly in front of apex of wing; cubitus forking below cross vein; anal angle of wing weak; surface hairs distinct.

Female.—Agrees with the male except that the tibiæ, tarsi, and halteres are paler, and the wings rather broader.

Length, 3–4 mm.

Illinois localities, Muncie, April 27—May 24, and Easton, May 1, 1914 (C. A. Hart and J. R. Malloch).

Originally described from Ithaca, N. Y. (April), and Washington State.

The early stages are unknown.

2. Tanytarsus dives Johannsen

Tanytarsus dives Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 288.

Larva.—Length, 6–7 mm. Blood-red, with a greenish tinge on the sides and a prominent hump on the anterior part of the dorsum of the last segment. Head dark, about one and a half times as long as wide; antennæ much elongated, about two thirds as long as the head, or fully as long when they are measured to the tips of the two long filaments of the second antennal segment. The first joint long and slender, with a slender seta on its side and a spur at the tip near the base of the second segment; second segment about three times as long as wide, with two long filaments at the tip near base of third segment. The third and fourth segments slender, delicate, and inconspicuous, the two taken together less than the length of the second joint. The dorsal sclerite of the head not distinctly separated from the laterals. Upon the dorsal aspect of the head are eight pairs of rather long setæ, two immediately behind base of antennæ close to median line, two on lateral margins, one behind and the other in front of eye spots, and two on disc in transverse line with the one behind eye spots. Labium similar to that shown in Figure 14, Plate XXIX. The body has no prominent hairs and no ventral blood-gills. (This description is partly copied from Johannsen, as my single example is in poor condition.)

Pupa.—"Length, 4 to 5 mm. Dusky, with the thoracic respiratory organs each consisting of a single slender shaft, with lateral hairs, about as long as a single abdominal segment. The dorsal surface of the abdomen is marked with minute setae as shown in figure, [Pl. XXXIX, Fig. 9]. This figure shows segments two to six inclusive. The dorsum of the second segment is nearly uniformly covered with fine, very short, microscopic spines, [and has] four or five pairs of pale setae and the usual chitinous, longitudinally ridged, posterior margin; the third has anteriorly two patches of short black spines, two patches of fine hairs, the rest of its dorsal surface punctate with minute spines, and five or six pairs of pale setae; the fourth, fifth, and sixth segments each have two dense patches of short black spines near the anterior margin, [are] sparsely punctate with minute spines and provided respectively with about eight, seven, and five pairs of pale setae. The eighth segment has the usual lateral fins, with its filaments, and has also the combs, each with five or six prominent black teeth."—*Johannsen.*

Imago; Male.—Black or brownish black, shining. Spaces between the vittæ sometimes yellowish brown. Legs fuscous, tibiæ

and tarsi brown. Wings slightly brownish owing to the dense covering of hairs, veins brown. Halteres yellow or pale brown.

Antennæ about one and a half times as long as head and thorax together, the plumes very long. Thorax projecting very much anteriorly; pronotum linear, not extending to upper margin of mesonotum. Hypopygium as in Figure 6, Plate XXXVI. Legs, including fore tarsi, with moderately long hairs; basal joint of fore tarsi nearly one half longer than fore tibiæ (63:44). Third vein ending well in front of apex of wing; cubitus forking below base of fourth.

Female.—Differs from the male in having the ground color of the thorax yellowish and the legs yellowish brown.

Except in the sexual characters and in the absence of long hairs on fore tarsi it agrees structurally with the male.

Length, 3.5–4 mm.

This species very probably occurs in Illinois. The only examples I have are one larva from Montana (C. C. Adams), and a male and a female sent me by Professor Johannsen from Ithaca, N. Y.

3. Tanytarsus neoflavellus, n. sp.

Male.—Yellow, slightly shining. Flagellum of antennæ slightly brownish. Abdomen greenish yellow. Legs entirely pale yellow, only the apical comb of the hind tibiæ black. Wings clear, veins entirely yellow. Halteres yellow.

Antennæ about one and a half times as long as head and thorax together. Thorax much swollen anteriorly; pronotum of moderate width, not continued to upper margin of mesonotum. Hypopygium similar in general appearance to that of *viridiventris* (Pl. XXXVI, Fig. 8), the superior process being like that of Figure 1 of same plate, and the inferior one as in Figure 8, *b*, Plate XL.

Fore tarsi exceptionally long, not very slender, and without long hairs; lengths of fore tibiæ and fore tarsal joints as follows: 24, 63, 25, 22, 19, 8; mid and hind legs with moderately long hairs. Wings distinctly hairy; third vein clearly ending before apex; cross vein appreciably before wing-middle and fork of cubitus.

Female.—Yellow, including the abdomen.

Agrees with the male except in sexual characters and in having the cross vein nearer to base of wing.

Length, 2.5–3.25 mm.

Type locality, Dubois, Ill., April 24–25, 1914, at light and by sweeping vegetation on bank of creek.

Early stages unknown.

4. Tanytarsus flavellus Zetterstedt

Chironomus flavellus Zetterstedt, Ins. Lappon., 1838, p. 816, sp. 41.

Johannsen records this European species from Ithaca, N. Y. I have some doubt as to the identity of the American specimens with the species recorded from Europe, but in the absence of examples of the latter accept the published record as authentic. The individuals which I have here referred to the species recorded from New York differ from the foregoing description of *neoflavellus* in being smaller, 1.75 mm., and in having the second joint of the fore tarsi nearly one half longer than the fore tibiæ, the lengths of the tibiæ and the first and second tarsal joints being respectively as 10, 27, 14.

The localities of my specimens are Lafayette, Ind., June 5 (J. M. Aldrich), and South Haven, Mich., July 15, 1914 (C. A. Hart).

The species almost certainly occurs in Illinois.

Early stages undescribed.

5. Tanytarsus confusus, n. sp.

This species differs from the foregoing in being considerably larger, 2.5–3.5 mm., and in having the proportions of the fore tibiæ and first and second tarsal joints different: male, 18, 53, 24; female, 12, 31, 15. The hypopygium is similar to that of *dives*, differing in the shape of the extension of the dorsal plate, and noticeably in the form of the superior process (Pl. XXXVI, Fig. 5). In many respects *confusus* resembles *neoflavellus*, but the proportions of the fore tibiæ and fore tarsi are quite different in the two species.

Type locality, Urbana, Ill., May and October, 1914. Paratypes from Havana, April, Muncie, May, and Momence, July, all in Illinois (C. A. Hart and J. R. Malloch); and from Washington, D. C. (W. L. McAtee).

6. Tanytarsus pusio Meigen

Chironomus pusio Meigen, Syst. Beschr. Eur. Zweifl. Ins., Vol. 6, 1830, p. 256, sp. 117.

Male.—Green. Head yellowish green; scape of antennæ and flagellum, except its extreme base, fuscous, plumes pale brown. Thoracic vittæ, the lower half of pleuræ, and greater portion of the postnotum blackish brown. Abdomen whitish green, apically yellowish. Legs white. Wings clear, veins colorless.

Antennæ 1.5 as long as head and thorax together. Pronotum linear; mesonotum produced anteriorly. Hypopygium similar to that of *C. fusciventris* (Pl. XXXVI, Fig. 1) except that the apical portion of lateral arm tapers very decidedly apically and that the superior process

is much more robust. Legs slender; basal joint of fore tarsi twice as long as fore tibiæ (30: 15); mid and hind legs with long hairs. Third vein ending at beginning of apical curve of wing; cross vein slightly before middle of wing; cubitus forking distinctly beyond cross vein.

Female.—Agrees with the male except in sexual characters and in having the cross vein more distinctly proximad of middle of wing.

Length, 1.5–2.25 mm.

Illinois locality, Muncie, May 24, 1914 (C. A. Hart and J. R. Malloch).

This European species has been recorded by Johannsen from Ithaca, N. Y., and Brookings, S. Dak.

Early stages undescribed.

This species is very difficult to observe in the field owing to its small size and the pale color of abdomen and legs, the dark thorax alone showing clearly.

7. Tanytarsus tenuis Meigen

Chironomus tenuis Meigen, Syst. Beschr. Eur. Zweifl. Ins. Vol. 6, 1830, p. 255, sp. 112.

This species agrees in color and length with *neoflavellus*, but differs noticeably in the proportions of the fore tibiæ and first and second joints of fore tarsi, the respective proportions being 20, 40, 20. The third vein ends slightly farther from apex of wing than in *neoflavellus*, while the cross vein is much nearer to base of wing than in that species, the distance from base of first vein to cross vein as compared with that from cross vein to apex of wing being as 22 to 46, while in *neoflavellus* they are as 36 to 51. In other respects the species are very similar.

Length, 3 mm.

Illinois locality, Rock Island, October 20, 1914, at light (C. A. Hart).

Lundbeck recorded this species from Greenland, and Johannsen from South Dakota and Washington State. I have before me a male specimen, submitted by Professor Aldrich, from Erwin, South Dakota, June, 1908, which is evidently this species.

Early stages undescribed.

8. Tanytarsus viridiventris, n. sp.

Male.—Head and thorax black, the latter shining. Abdomen bright green. Legs yellowish green, coxæ blackened. Wings whitish, veins pale. Halteres pale green. Antennal plumes pale brown.

Antennæ less than one and a half times as long as head and thorax together. Thorax distinctly produced anteriorly; pronotum narrow, not continued to upper margin of mesonotum. Abdomen slender; hypopygium as in Figure 8, Plate XXXVI. Legs without long hairs; basal joint of fore tarsi more than one half longer than fore tibiæ (26:16). Cross vein almost at middle of wing; cubitus forking slightly beyond cross vein; third vein ending distinctly before curve at apex of wing; surface hairs of wing pale and sparse.

Length, 2.5 mm.

Type locality, shore of Lake Michigan at South Haven, Mich., July 14, 1914 (C. A. Hart).

Female and early stages unknown.

This species bears a close resemblance to *pusio*, but is distinguishable by the entirely black thorax, the form of the hypopygium, and the length of the basal joint of the fore tarsi in comparison with that of the fore tibiæ.

9. Tanytarsus obediens Johannsen

Tanytarsus obediens Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 286.

Male.—Black, slightly shining. Head brownish black; antennæ fuscous, scape and extreme base of flagellum yellow, plumes fuscous, whitish at the tips. Mesonotum with very faint pruinescence on area between the vittæ; anterior lateral angles of thorax sometimes yellowish; scutellum varying from brown to yellowish. Posterior margins of abdominal segments and the lateral margins on posterior half yellow; hypopygium blackish brown. Legs almost white, bases of mid and hind coxæ blackened. Wings whitish, veins pale yellow; surface hairs yellow. Halteres yellow, knob white.

Frontal tubercles absent; antennæ about 1.5 as long as head and thorax together; palpi longer than height of head, apical joint distinctly longer than subapical. Pronotum linear on upper half; mesonotum produced anteriorly. Hypopygium as in Figure 9, Plate XXXVI. Legs long and slender, fore tarsi without long hairs, basal joint about one fifth longer than fore tibiæ. Third vein ending slightly farther from apex of wing than does fourth; cubitus forking below cross vein.

Female.—Agrees with the male in color except that the antennæ are yellow and the abdominal segments have narrow pale posterior margins.

Length, 3.5–4.5 mm.

Illinois localities, Lilly and Havana, June (C. A. Hart).

A male from Monticello has the basal joint of fore tarsi more than one third longer than the fore tibiæ, but in other respects agrees with the foregoing description.

Originally described from Ithaca, N. Y., and Washington State. I have seen specimens from Lafayette, Ind. (Aldrich), Plummer's Island, Md. (McAtee), and from Niles, Mich. (Hart).

10. Tanytarsus flavicauda, n. sp.

Male.—Differs in color from *obediens* in having the flagellum and plumes of the antennæ and also the palpi yellowish, the abdomen without yellow posterior margins to the segments, and the apical portion of lateral arm of hypopygium pale yellow.

Structurally the species are similar, the principal distinctions being found in the hypopygium, the apical portion of the lateral arm in *flavicauda* being much longer than the basal portion, whereas in *obediens* it is slightly shorter.

Female.—Similar to the female of *obediens*, but differing in that the segments of the abdomen are without pale posterior margins.

Length, 3–4 mm.

Type locality, Carbondale, Ill., April 23, 1914. Paratypes from Illinois River at Havana, April 29, 1914 (C. A. Hart and J. R. Malloch).

Early stages unknown.

11. Tanytarsus politus, n. sp.

Male.—Greenish yellow, shining. Head yellow; antennæ, with the exception of the base of flagellum, fuscous; palpi brown. Vittæ glossy blackish brown; lower part of sternopleura and greater part of postnotum concolorous with vittæ. Abdomen generally unicolorous brown, but sometimes with only the apices of segments of the basal half and the whole of the segments of the apical half brown. Legs pale brown, fore femora and tibia usually darkened. Wings clear, veins and surface hairs brownish. Antennal plumes and surface hairs on legs pale brown. Halteres greenish white.

Length of antennæ more than one and a half times that of head and thorax together. Pronotum of moderate breadth; mesonotum but slightly produced anteriorly. Hypopygium similar to that of *dives*, the only appreciable difference lying in the shorter and broader extension of the dorsal plate. Legs rather slender; fore tarsi without long hairs, basal joint a trifle less than one half longer than fore tibiæ (48 : 33); mid and hind legs with moderately long hairs. Third vein

ending at beginning of apical curve of wing, the cell enclosed by it rapidly narrowing apically; cross vein very little before middle of wing; cubitus forking very slightly before cross vein.

Length, 3 mm.

Type locality, Easton, Ill., taken by sweeping vegetation along bank of Central Dredge Ditch, May 1, 1914 (C. A. Hart and J. R. Malloch).

This is very probably the species listed by Johannsen as *gmundensis* Egger. I can not reconcile the above description with Egger's description of *gmundensis* or with Schiner's later description of it. Johannsen based his identification of the European form upon material obtained from Europe, but there seems to me very good grounds for rejecting the identification as erroneous, although possibly he made no mistake in associating his American examples with the European ones. I assume that I am correct in my inference as to what species Johannsen had before him, since I have examined a specimen in the collection of the U. S. Bureau of Biological Survey, from Plummer's Island, Md., which bears Johannsen's MS. label *"gmundensis."*

12. Tanytarsus muticus Johannsen

Tanytarsus muticus Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 294.

Female.—Yellow, slightly shining. Head yellow, apical joint of antennæ fuscous. Mesonotum with reddish vittæ. Abdomen green. Legs yellow, fore pair slightly brownish. Wings clear, veins yellow.

Pronotum linear; mesonotum protruding anteriorly. Basal joint of fore tarsi one fourth longer than fore tibiæ, proportions of tibiæ and first and second tarsal joints, 20, 25, 14. Third vein ending just beyond beginning of apical curve of wing; distance from base of first vein to cross vein less than one half that from cross vein to apex of wing (22 : 51); cubitus forking conspicuously beyond cross vein.

Length, 1.75 mm.

Illinois locality, Urbana, October, 1914, at light (C. A. Hart and J. R. Malloch).

The male of this species was described by Johannsen from Ithaca, N. Y. I have not seen this sex, but have little hesitation in associating the female described above with Johannsen's species.

The early stages are undescribed.

13. Tanytarsus similatus, n. sp.

Male.—Blackish brown. Head black, flagellum and plumes of antennæ fuscous. Thoracic vittæ glossy black, spaces between them

brownish, with slight whitish pruinescence. Abdomen brownish black, hypopygium slightly paler. Legs pale brown, tibiæ and bases of tarsi paler. Wings clear, cross vein unclouded, veins pale brown. Halteres yellowish brown.

Pronotum tapering rapidly towards upper margin, discontinued before upper extremity of mesonotum. Hypopygium somewhat like that of *viridiventris*, differing in the structure of the superior and inferior processes (Pl. XL, Fig. 8), in the much shorter auxiliary process which does not reach beyond the apex of the inferior process, and in the shape of the extension of the dorsal plate, which tapers more gradually and has a single transverse series of hairs near base of constricted portion. Fore tarsi without long hairs; basal joint one fifth longer than fore tibiæ (42 : 35); mid and hind legs with long pale hairs. Third vein ending just beyond beginning of apical curve of wing; cross vein at middle of wing.

Female.—Differs from the male in having the ground color of thorax yellowish and the apices of the abdominal segments narrowly pale .

The basal joint of fore tarsi is one tenth longer than the fore tibia (33 : 30).

Length, 3 mm.

Type locality, Madison, Wis., May 1, 1910 (J. G. Sanders).

14. Tanytarsus exiguus Johannsen

Tanytarsus exiguus Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 294.

Larva.—Length, 3–4 mm. Greenish, or yellowish, head brown. Case with three filaments projecting at apex. Antennæ more than one and a half times as long as mandible, apical process of basal joint longer than second joint; labial plate somewhat similar to that shown in Figure 19, Plate XXIX, the central tooth with more distinct shoulders forming weak subapical teeth, the first lateral tooth also with shoulder on outer side; mandible with three distinct teeth on ventrolateral margin.

Pupa.—Length, 2–3 mm. Yellow. Thoracic respiratory organs slender, simple, pointed apically, without distinguishable surface hairs; second abdominal segment with apical transverse series of black setulæ, and two large subtriangular patches of very weak setulæ on dorsum; third segment with two small rounded patches of conspicuous black setulæ near apex, the dorsum posterior to these being covered with weak setulæ; fourth segment with a conspicuous group of black setulæ near base of median line and two weaker elongate submedian

patches posterior to it; fifth segment with two small but conspicuous groups of black setulæ near base, and many weaker setulæ on dorsum.

Imago; Male.—Differs from *tenuis* in being a little more distinctly vittate.

Structurally the male is distinguishable from *tenuis* by the shorter basal joint of the tarsi, the proportions of tibiæ and tarsi being 30, 18. In other respects the two species are very similar.

Female.—Pale yellow. Mesonotum without vittæ.

Agrees with the male except in sexual characters and in having the cross vein slightly nearer to base of wing.

Length, 1.5–2 mm.

Illinois localities: Momence, July 17, 1914 (C. A. Hart); and the Illinois River at Havana (larvæ and pupæ).

Originally described from Ithaca, N. Y. I have before me one male specimen from the type locality, and two others of this sex from Moscow, Idaho, the former submitted by Professor Johannsen, and the latter by Professor Aldrich.

15. Tanytarsus dubius, n. sp.

Male.—Agrees in color with *politus* except that the abdomen is usually bright green.

Structurally also there is a striking similarity to *politus*, the principal distinctions being in the comparative lengths of the basal joints of the fore tarsi and the fore tibiæ. In the present species the basal joint of the tarsi is distinctly more than one half longer than the tibiæ (40:25), while in *politus* it is slightly less than this. The hypopygia of the two species are so similar in general appearance that they are of little service as a means of differentiation, both being very similar to the hypopygium of *dives*. The distance from base of first vein to cross vein in the present species is distinctly less than the distance from the cross vein to apex of wing (35:46), and the cubitus forks slightly beyond the cross vein.

Female.—Differs from the male only in sexual characters and in venation, the cross vein being slightly nearer to base of wing and the cubitus forking more distinctly beyond the cross vein.

Length, 2.5–3.5 mm.

Type locality, Havana, Ill., along shore of Illinois River, April 28-29, 1914 (C. A. Hart and J. R. Malloch).

Metriocnemus Van der Wulp

Very few species of this genus are represented in the collections of this Laboratory, and no attempt is here made to revise the North American species. One species, *lundbecki* Johannsen, has been reared by the writer, and full descriptions of its stages are published in the Proceedings of the Entomological Society of Washington.* In the present paper only brief descriptions of the stages are included.

Kieffer has based the separation of several species from those of *Metriocnemus* on the structure of the apical portion of the lateral arm of the hypopygium and the presence of well-developed pulvilli. Species which have the above portion of the hypopygium simple are retained in *Metriocnemus*, while those that have this process bifid are placed in his new genus *Brillia*, I have seen a single species which is referable to *Brillia*, but as the genus does not occur in Illinois, as far as I am aware, I shall not include it in this paper.

When Johannsen wrote his 1905 paper on this family, the larva and pupa of only one North American species of *Metriocnemus* were known, and they possess characters which, although used by Johannsen in his generic keys to these stages, the larva and pupa of *lundbecki* lack, and consequently in using the said keys to locate larvæ and pupæ it is evident that those of *lundbecki* at least could not possibly be placed in *Metriocnemus*. I have avoided the use of generic keys for larvæ and pupæ because, with our present very imperfect knowledge of the *Chironomidæ*, mistakes in generic identification and classification are almost certain to occur, and little good could now be accomplished by adopting as a basis of generic separation characters possessed by the few known species, which may be of specific and not real generic value.

The imagines of *Metriocnemus* may be distinguished from those of any other genus in the *Chironominæ* by the following characters: antennæ of male 15-jointed (2+13), those of female 8-jointed (2+6); wings hairy; basal joint of fore tarsi shorter than fore tibiæ; pulvilli small or nearly wanting; hypopygium with apical portion of lateral arm simple, armed with a small thorn at apex.

Although but two species have been taken by the writer in Illinois, one of them being hitherto undescribed, it is highly probable that many species occur in the state and will be discovered later.

*Vol. 16, 1914, p. 132.

1. Metriocnemus lundbecki Johannsen

Chironomus nanus Lundbeck (*nec* Meigen), Vidensk. Meddel., 1898, p. 285.
Metriocnemus lundbecki Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 302.

Larva.—Length, 4–5 mm. Yellowish. Labium with the central tooth divided, general outline similar to that shown in Figure 16, Plate XXIX, except that the divided central tooth has no shoulder; mandible with 4 distinct teeth in addition to the apical one.

Pupa.—Length, 3 mm. Greenish yellow. Thoracic respiratory organs similar to those of *Orthocladius nivoriundus.* Abdominal segments 2–8 with dorsum covered with short setulæ which become stronger posteriorly and form a distinct transverse band on caudal margin; apical appendages with 3 long hairs.

Imago; Male.—Yellow, slightly shining. Mesonotum with reddish vittæ. Abdomen yellow, apical 2–3 segments brownish. Legs yellow, apices of tarsi infuscated. Wings clear, veins yellow. Halteres yellow.

Fore tarsi with basal joint nearly three fourths as long as fore tibiæ. Hypopygium with dorsal plate long and pointed. Third vein ending at beginning of apical curve of wing.

Female.—Agrees in color with the male.

Length, 2–2.5 mm.

Illinois localities: Muncie, March 16, 1914, and Havana, November 8, 1912 (C. A. Hart).

I have seen a female specimen, submitted by Prof. O. A. Johannsen, from Ithaca, N. Y.

2. Metriocnemus brachyneura, n. sp.

Male.—Head brownish, antennæ, including the plumes, fuscous. Thorax greenish yellow; mesonotum with glossy blackish brown vittæ, the spaces between them covered with whitish pruinescence; pleuræ with a large brownish spot on sternopleura and a smaller one in front of wing-base; scutellum yellowish; postnotum brown. Abdomen fuscous-green. Legs greenish yellow, brownish on apices of femora and of mid and hind tibiæ, the fore tibiæ, except on middle, and apices of all tarsi brown. Wings clear, veins and surface hairs brown. Halteres greenish yellow.

Last flagellar joint not as long as the preceding joints combined. Pronotum linear. Hypopygium as in Figure 4, Plate XL. Legs slender; fore tarsi without long hairs, basal joint more than two thirds as long as fore tibiæ (17:22); empodium distinct, fringed. Third

vein ending considerably in front of apex of wing (Pl. XXXIX, Fig. 17); surface of wings with very distinct hairs.

Female.—Differs from the male in being much paler in color, the abdomen having only brownish markings on anterior portions of dorsal segments.

The legs are rather stouter and somewhat shorter than in the male, the proportions of the basal joint of fore tarsi and fore tibiæ being as 12, 18, and the surface hairs on wings are more distinct than in the male.

Length, 1–1.25 mm.

Type locality, Muncie, Ill., May 24, 1914, swept from vegetation on bank of Stony Creek (C. A. Hart and J. R. Malloch).

Allotype and paratypes from Madison, Wis., August 26, 1913, at light (A. C. Burrill).

This species differs from *lundbecki* in having the third vein very much shorter—a character which will distinguish it also from every other described North American species of *Metriocnemus*.

Chasmatonotus Loew

The species of this genus are separable from those of any other chironomid genus occurring in North America by the presence on the thoracic dorso-median line of a distinct narrow furrow or fissure which extends beyond the middle of the disc. The antennæ in both sexes are short- haired and consist of eight joints (2+6). The venation is somewhat similar to that of *Orthocladius* (Pl. XXXV, Fig. 8). Only one species has been taken in Illinois as far as I am aware. The other four North American species of the genus have been collected as follows: *univittatus* Coquillett, in Alaska; *unimaculatus* Loew, in New Hampshire; *fascipennis* Coquillett, in British Columbia; and *hyalinus* Coquillet, in California.

— Chasmatonotus bimaculatus Osten Sacken

Chasmatonotus bimaculatus Osten Sacken, Bull. U. S. Geol. Surv., Vol. 3, 1877, p. 191.

This species is distinguishable from any of the others in the genus by the wing-markings (Pl. XXXV, Fig. 8). The hypopygium is shown in Figures 7 and 10, Plate XXXVI.

Illinois localities: Lake Forest (Johannsen); Urbana, May (C. A. Hart); St. Joseph, six specimens swept from undergrowth May 17, 1914 (C. A. Hart and J. R. Malloch).

Recorded from New York, New Jersey, and Quebec.

Early stages undescribed.

Pseudochironomus, n. gen.

The only species of this genus may be distinguished from *Chironomus* by the short basal joint of the fore tarsi—the length of which is distinctly less than that of the fore tibiæ—the distinct apical spur of the hind tibiæ, and, except in the case of one or two rather aberrant species of that genus, by the shorter third vein, which ends distinctly farther in front of the wing-apex than the fourth vein does behind it. In most respects the genus more closely resembles the members of the old genus *Orthocladius* in the wide sense, but the hypopygium has a much closer affinity with hypopygia of *Chironomus* than with those of *Orthocladius*, the apical portion of the lateral arm being straight—not recurved—and without an apical thorn (Pl. XXXVII, Fig. 16). It is more difficult to separate the female from the species of the subgenus *Psectrocladius*, to which its large pulvilli, and distinct, fringed empodia would relegate it; but it is more robust, the pronotum has a deep and broad median incision, the post-humeral area has a circular shining depression, and the fore tibia is not conspicuously longer than the basal joint of the fore tarsi.

I have obtained what I believe to be the pupa of the species, which is described herewith.

Type of genus, *Pseudochironomus richardsoni*, n. sp.

Pseudochironomus richardsoni, n. sp.

Larva.—Unknown.

Pupa.—Length, 6–8 mm. Brown. Frontal tubercles small, acute apically. Thorax with small closely placed, apically rounded squamules; thoracic respiratory organs broken in specimens before me. First abdominal segment without setulæ; disc of segments 2–6 covered with distinct setulæ, a conspicuous and rather broad band of these setulæ near bases of segments 2 to 4, that on the latter composed of weaker setulæ than those on the other two segments, the setulæ becoming much weaker and being very closely placed as they recede from base; segments 5 and 6 without distinct band, but with a large rounded patch of setulæ which are much longer, though but slightly darker, and are much more closely placed than those on the remainder of disc; second segment with the usual transverse apical row of setulæ; segments 3 and 4 with a narrow, transverse band of setulæ near posterior margin, separated from the setulæ on disc by a bare strip; apical lateral angle of eighth segment with an irregular comb of short thorns; lateral margins of segments with a few long flattened hairs, fringe of apical appendages confined to apical half, regular in length, and consisting of many flattened hairs.

Imago; Male.—Brown-black to deep black, slightly shining. Head, including antennal plumes, fuscous. Thorax with gray pruinescence which is particularly distinct between the vittæ, the latter distinctly shining; scutellum and postnotum subshining, black. Abdomen black, shining, the posterior margins of the segments usually covered with grayish pruinescence. Legs varying in color from brownish yellow to fuscous, the bases of femora, the tibiæ, and bases of tarsi generally slightly paler than other portions. Wings slightly grayish, veins pale brown; Halteres yellowish or pale gray.

Antennæ rather thick and short, flagellum tapering from base to apex, entire antennal length about equal to that of head and thorax together, number of joints 15. Pronotum of moderate breadth, central excision wide. Hypopygium as in Figure 16, Plate XXXVII. Legs rather stout; fore tarsi without long hairs, basal joint about nine tenths as long as fore tibiæ (47: 52), second joint less than half as long as basal (21); mid and hind legs with rather short hairs; all tarsi with well-developed pulvilli and empodia. Cross vein at middle of wing; third vein ending much farther in front of wing-apex than fourth does behind it; cubitus forking slightly beyond cross vein, its posterior branch almost straight.

Female.—Agrees with male in color.

Differs in having 8-jointed antennæ and the mid and hind legs without hairs, their surfaces having only short pubescence.

Length, 3.5–4.5 mm.

Type locality, Havana, Ill., April 28 to May 2, 1914 (C. A. Hart and J. R. Malloch). Paratypes from Momence, Ill., July 17, 1914, at light (C. A. Hart), and from Washingon, D .C., August 6, 1907 (W. L. McAtee).

The species occurred in great numbers on the Illinois River, and specimens were captured at a considerable distance from it, where no suitable breeding places were available, evidently having been carried there by the wind.

The species is named in honor of Mr. R. E. Richardson, who has been for several years studying the biology of the Illinois River in connection with the work of the State Laboratory.

Cricotopus Van der Wulp

This genus as originally defined by Van der Wulp was a rather arbitrary one, separated as it was from *Orthocladius* merely by the color of the legs. In *Cricotopus* the legs are pale yellow, or whitish, and black, while in *Orthocladius* they are unicolorous black or yellowish, rarely yellow with brown markings. Occasionally, however, the

legs of a species are so colored that one has some hesitation in assigning it definitely to either genus. *Orthocladius politus* is a case in point. The legs in *politus* are bicolored, but the colors are not sharply contrasted. The eyes possess distinct surface hairs, however, which seems to indicate a closer affinity with *Cricotopus* than with *Orthocladius*. A subgenus of *Orthocladius, Trichocladius,* has been erected by Kieffer for the reception of those species of *Orthocladius* which have hairy eyes. This subgenus is said to be distinguished from *Cricotopus* by the absence of pulvilli—a rather unsatisfactory character, and one difficult to see. In the present paper several species are located in *Trichocladius*. It is not the writer's intention to take up at present the question of the generic relations of doubtfully located American species of this group, but it is hoped that at some future time either he or some other student of the group may have an opportunity to devote to this problem the time requisite for its solution.

The known larvæ and pupæ of this genus are included in the keys to the early stages of the subfamily *Chironominæ*.

Key to Illinois Species

1. Males 2
— Females 5
2. Fore tarsi with long hairs; basal segment of abdomen and narrow posterior margins of other segments yellow.....1. *flavibasis.*
— Fore tarsi without long hairs.....3
3. First, fourth, and seventh abdominal segments yellow, remainder black .....2. *trifasciatus.*
— At most but two abdominal segments entirely yellow.....4
4. First and fourth abdominal segments yellow.....3. *bicinctus.*
— First segment largely and posterior margins of other segments narrowly yellow.....4. *sylvestris.*
5. Abdomen with first, fourth, and seventh segments yellow.....
.....2. *trifasciatus.*
— Abdomen with at most 2 segments entirely yellow.....6
6. Fore tarsi black, second joint and basal half of third yellow.....
.....5. *slossonæ.*
— Fore tarsi unicolorous, black or brown.....7
7. Abdomen with first and fourth segments yellow.....3. *bicinctus.*
— Abdomen with narrow yellow posterior margins to segments, the basal segment broadly yellowish.....1. *flavibasis.*

1. Cricotopus flavibasis, n. sp.

Male.—Yellow, shining. Head yellow, antennæ fuscous, scape black, plumes fuscous, paler apically; palpi brown. Mesonotum with

the vittæ black, very broad; pleuræ largely black; scutellum yellow; postnotum shining black. Abdomen velvety black, basal segment yellow, slightly darkened, apices of remaining segments and bases of third and fourth shining yellow; hypopygium yellow. Legs yellow, mid and hind coxæ, fore femora except the bases, apices of mid and hind femora, fore tibiæ except the middle, both ends of mid and hind tibiæ, the entire fore tarsi, apices of basal three joints and whole of apical two of other tarsi blackened. Wings whitish, veins yellow. Halteres pale yellow, base of pedicels blackened.

Antenna barely longer than head and thorax together. Pronotum broad, of almost equal width throughout. Hypopygium as in Figure 4, Plate XXXVII. Legs slender; fore tarsi with rather long hairs; basal joint slightly more than half as long as fore tibiæ (23 : 45); second joint about half as long as basal (12). Wing venation almost identical with that of *trifasciatus*.

Female.—Agrees with the male in color except that the dark color on thorax is not so conspicuous, and that on abdomen more generally distributed, though the basal segment is almost entirely yellow. The legs have the black more sharply differentiated from the pale portions and confined to smaller areas.

Length, 3–5 mm.

Type locality, Urbana, Ill., October 5–9, 1914, at light (C. A. Hart and J. R. Malloch).

The fore tarsal hairs and distinctively marked abdomen should serve to separate this from every other described American species.

2. Cricotopus trifasciatus Panzer

Chironomus trifasciatus Panzer, Fauna Germ., 1813, p. 109.

Cricotopus trifasciatus (Panzer) V. d. Wulp, Tijdschr. v. Ent., Vol. 17, 1874, p. 132.

Egg.—(Pl. XXXVIII, Fig. 7). Whitish. Deposited in long rope-like masses.

Larva.—Length, 4–5 mm. Yellow, varying sometimes to reddish. Head about 1.5 as long as wide; antenna as in Figure 9, Plate XXX; mandibles with three distinct teeth in addition to the apical one; labium as in Figure 12, Plate XXIX. Abdomen with a peculiar tuft of long pale hairs near posterior margin of the lateral surface of each segment, which are weak on segments 1 and 2; anal dorsal respiratory organs distinct, four in number, ventral surface without anal blood-gills; anal pseudopods short, armed at apices with the normal claws.

Pupa.—Length 3–4 mm. Yellow, the black markings of the enclosed imago showing through (Pl. XXXII, Fig. 7). Thoracic respiratory organs slender, tapering, inconspicuous, their surfaces without distinct hairs; several long and slender hairs on pronotum and a few on disc of mesonotum. Abdomen with the dorsal segments covered with minute setulæ except on some small rounded areas on disc of each segment, the usual apical transverse series of strong setulæ on second segment, and a transverse preapical patch of weaker and broader ones on the other segments; apical appendages short and rather slender, armed apically with three long hairs.

Imago; Male.—Yellow, shining. Head yellow, scape of antennæ black, flagellum and palpi fuscous, antennal plumes yellowish brown. Mesonotum with glossy black vittæ which are sometimes confluent and obscure the ground color; pleuræ with a large black patch on sternopleura and a smaller one before wing-base; scutellum and postnotum opaque black. Abdomen either opaque black with first, fourth, and seventh segments and apical half of hypopygium yellow, or yellow with second, fifth, and sixth segments, except their anterior fourth, the whole of eighth segment, and a spot on disc of fourth black. Legs whitish yellow, conspicuously blackened on all knee joints and apices of tibiæ; fore tarsi black, mid pair blackened from near base of second joint to apex of fifth, hind pair from before apex of third to apex of fifth. Wings clear, veins yellowish. Halteres pale yellow.

Antenna slightly longer than head and thorax together. Pronotum rather broad, its breadth almost uniform throughout. Apical portion of lateral arm of hypopygium as in Figure 2, Plate XXXVII. Fore tarsi without conspicuous hairs, basal joint more than half as long as fore tibiæ (30:53), second joint half as long as basal (15). Third vein ends at beginning of apical curve of wing; cross vein slightly proximad of wing-middle; cubitus forking distinctly beyond cross vein.

Female.—Agrees in color with the male.

Structurally also very similar, but the wings are rather broader and the legs slightly stouter.

Length, 3–4 mm.

Illinois localities: Illinois River at Havana—abundant, the eggs sometimes found in immense numbers floating in a large gelatinous mass—Grand Tower, Dubois, Golconda, Peoria, Momence, Rock Island, Urbana, Muncie. Probably the species occurs throughout the state. Dates of occurrence range from April 18 to October 20.

Originally described from Europe. Previously recorded by Johannsen from New York and Chicago. I have seen a specimen taken on prairie flowers at Moscow, Idaho, by Professor Aldrich.

I have reared several specimens of this species from larvæ obtained in the clear-water reservoir for the city supply in Champaign, Ill., December 29, 1914. The specimens emerged January 20 and 21, 1915. One male lived from January 20 to January 26 under conditions similar to those mentioned under *Chironomus viridicollis*.

3. Cricotopus bicinctus Meigen

Chironomus bicinctus Meigen, Syst. Beschr. Eur. Zweifl. Ins., Vol. 1, 1818, p. 41, sp. 48.

Cricotopus bicinctus V. d. Wulp, Tijdschr. v. Ent., Vol. 17, 1874. p. 132.

Male.—Distinguishable from *trifasciatus* by the color of the thorax and abdomen. The former is almost invariably uniform glossy black, while the latter has the first and fourth segments and apical portions of hypopygium yellow.

Structurally the principal differences lie in the proportions of the fore tibiæ and tarsi. In *bicinctus* the tarsi are much more slender and elongate than in *trifasciatus*, the proportions of tibiæ and basal two joints of tarsi being 40, 25, 15, the combined lengths of the latter being equal to that of the tibiæ, whereas in *trifasciatus* the lengths of the same joints combined are distinctly less than that of the tibiæ. The hypopygium is figured on Plate XXXVII, Figure 1. The wing venation is similar to that of *trifasciatus* except that the cross vein is usually somewhat thickened and darkened.

Female.—Agrees with the male in color except that the ground color of the thorax is generally yellow, with three glossy black vittæ.

Length, 1.75–2.5 mm.

Illinois localities, Parker, Carbondale, Grand Tower, Havana, Dubois, Muncie, Monticello, Urbana, Momence.—April to November. Commonly occurs at light.

Originally described from Europe.

Johannsen recorded this species from New York. I have seen specimens from Niles, Berrien Springs, and South Haven, Mich. (C. A. Hart), and from Lafayette, Ind. (J. M. Aldrich).

The early stages are undescribed.

4. Cricotopus sylvestris Fabricius

Tipula sylvestris Fabricius, Ent. Syst., 1794, p. 252, sp. 89.

Chironomus sylvestris Fabricius, Syst. Antl., 1805, p. 47, sp. 46.

Cricotopus sylvestris (Fabricius) V. d. Wulp, Tijdschr. v. Ent., Vol. 17, 1874, p. 132.

Male.—This species bears a strong resemblance to *flavibasis*, differing principally in size (2–3 mm.) and in color. The single speci-

men before me which I consider referable to this species has the thorax glossy yellow, the vittæ black, almost confluent, the scutellum, postnotum, and greater portion of pleuræ shining black, the abdomen opaque black, with the base of first segment broadly and the apices of remaining segments narrowly yellow. The legs, especially the fore tibiæ and mid and hind tarsi, are noticeably paler than in *flavibasis*. The fore tarsi are missing in my specimen, but no mention is made by previous authors of the presence of long hairs, which distinguish *flavibasis*.

Length, 1.75–2.25 mm.

Illinois localities: Illinois River near Havana, September 13, 1895; Chicago (Johannsen).

Originally described from Europe. Recorded for New Jersey by Johnson.

Early stages undescribed.

5. Cricotopus slossonæ, n. sp.

Female.—Black. Head yellowish brown; antennæ yellow, flagellum pale brown; palpi brown. Mesonotum glossy black, anterior angles and pronotum yellow, pleuræ glossy black, yellowish on upper margin; scutellum opaque, velvety black; postnotum opaque black. Basal two segments of abdomen lemon-yellow, remaining segments velvety black; genitalia pale yellow. Legs fulvous; apical joint of mid and hind tarsi brownish, other parts blackened as follows: basal portions of hind coxæ, all femora from before middle, bases of all tibiæ and their apices broadly, and the entire basal joint of fore tarsi and from middle of third to apex of fifth joint. Wings clear, veins brownish. Halteres whitish yellow.

Frons half the width of head; antennæ shorter than palpi and rather slender, the palpi robust. Pronotum rather broad, carried almost to upper margin of mesonotum, central incision weak. Basal joint of fore tarsi more than two thirds the length of fore tibiæ (45: 65); second joint almost half as long as basal. Cross vein upright, rather thick, distinctly before middle of wing; third vein distinctly thicker than costal, ending beyond beginning of apical curve, but farther from apex than fourth; cubitus forking slightly beyond cross vein.

Length, 3–3.5 mm.

Type locality, Algonquin, Ill., June 4, 1894 (W. A. Nason). Paratype from Mt. Washington, N. H. (Mrs. A. T. Slosson).

Named in honor of Mrs. A. T. Slosson.

C. varipes Coquillett agrees fairly well with the above description, but the fore tarsi in the female are of a uniform brown color. The

male of *varipes* has the second and third fore tarsal joints paler than the first, but not yellow.

Camptocladius Van der Wulp

In my generic key to the *Chironominæ* I have placed only those genera that have been regarded as valid by previous American writers who have dealt with the family. In adopting this course I have separated *Camptocladius* from *Orthocladius* by means of the character of the posterior branch of the cubitus, which in *Camptocladius* is bisinuate, while in *Orthocladius* it is straight or very slightly recurved at the apex. In treating *Orthocladius* I have accepted Kieffer's subgenera as divisions, and find that to be consistent one must adopt a similar course with respect to *Camptocladius*, though divisions have not previously been indicated. I propose no names for the divisions of *Camptocladius* as defined in key herewith, considering it desirable that further investigation of more material and from a larger area than I am dealing with should be made before these concepts are accepted as of generic or even subgeneric value—separable as they are from those of *Orthocladius* only by the character of venation already indicated. It would probably be quite legitimate to disregard the sinuation of the cubitus in the case of the species which possess hairs on the eyes, placing them in *Trichocladius*, but lack of information regarding the early stages and the paucity of my material prevent me from adopting this course.

I have not succeeded in obtaining the early stages of any species of *Camptocladius*, but two species have been reared in this country from dung, and the fact that *Orthocladius stercorarius* DeGeer has been similarly reared seems to indicate that it belongs to *Camptocladius* rather than to *Orthocladius*, the larvæ of the latter being aquatic in habit as far as at present known. *O. stercorarius* is a European species that has been recorded as occurring in Greenland. It is unknown to me.

Key to Species

1. Eyes with short upright hairs.....2
— Eyes bare 3
2. Large species, 2 mm. or more in length; base of wing-veins black; female with broad sensory organs on flagellar joints...1. *lasiops.*
— Smaller species, 1 mm. in length; base of wing-veins not black; female with hairlike sensory organs on flagellar joints.....
.....2. *lasiophthalmus.*
3. Basal 2 joints of flagellum in female very distinctly separated, all flagellar joints in this sex with broad sensory organs; black spe-

cies, the male with whitish wings; empodia distinct.....
.....3. *byssinus.*
— Basal 2 joints of flagellum in female closely fused, all flagellar joints in this sex with hairlike sensory organs; yellowish species; wings of male not milky; empodia distinct.....4
4. Basal joint of fore tarsi about half as long as fore tibiæ.....5
— Basal joint of fore tarsi nearly two thirds as long as fore tibiæ (21:34) .....4. *aterrimus?*
5. Yellow species, thorax with brownish vittæ or entirely yellow.....
.....5. *flavens.*
— Black species 6
6. Base of wing whitish.....6. *flavibasis.*
— Thick veins at wing-base blackened.....7. *subaterrimus.*

1. Camptocladius lasiops, n. sp.

Male.—Black, slightly shining. Head black, antennal flagellum and plumes fuscous. Legs black; tibiæ and tarsi fuscous. Wings slightly grayish, veins brown. Halteres black or brown. Hairs on body and legs fuscous.

Eyes with short upright hairs between the facets; palpi with 4 joints, the basal joint inserted in a distinct prominence; at least the third flagellar joint with rather broad sensory organs, apical flagellar joint about twice as long as preceding joints taken together. Pronotum narrow; central dorsal excision distinct. Hypopygium as in Figure 8, Plate XXXVIII. Legs slender; fore tarsi with the hairs very slightly longer than those on fore tibiæ, basal joint slightly more than half as long as fore tibia (15:28); mid and hind legs with moderately long hairs; empodia as long as the claws, distinctly fringed. Third vein ending at beginning of apical curve of wing, venation of apical portion as in Figure 6, Plate XXXIX.

Female.—Agrees with the male in coloration.

Antenna as in Figure 13, Plate XXXII. The wing differs from that of male in having the costa prolonged over a third of the distance from apex of third vein to apex of wing.

Length, 1.5–2.75 mm.

Type locality, Urbana, Ill., November 19, 1914, taken near house in city (C. A. Hart and J. R. Malloch). Paratypes from same locality March 29 and in September and October, 1914 (same collectors).

This species may belong to *Trichocladius*, though the bisinuate posterior branch of the cubitus and the place of occurrence of the imagines would seem to indicate that the larva is terrestrial.

2. Camptocladius lasiophthalmus, n. sp.

Female.—Brownish black, shining. Head black, antennæ and palpi fuscous. Mesonotum with slight grayish pruinescence on disc. Abdomen black, subopaque, venter yellowish. Legs brownish yellow, trochanters and bases of femora yellow. Wings grayish, veins brown, base of wings and of veins whitish yellow. Halteres brownish yellow.

Eyes hairy. Antenna with oval flagellar joints, much longer than their diameter, sensory organs hairlike, similar to those shown in Figure 15, Plate XXXVIII. Pronotum rather broad, no central dorsal excision. Mesonotum produced very distinctly anteriorly, surface hairs strong but sparse, pruinescence sparse. Abdomen with rather strong hairs. Legs of moderate strength; basal joint of fore tarsi half as long as fore tibiæ; mid and hind legs with rather short hairs; apical spurs on hind tibiæ short, empodium about as long as claws, distinctly fringed. Third vein ending slightly beyond beginning of apical curve of wing and apex of upper branch of cubitus; costal vein extending almost to apex of wing; distance from cross vein to apex of first less than distance from apex of first to apex of third; cross vein distinctly proximad of wing-middle; cubitus forking distinctly beyond cross vein, posterior branch rather abruptly sinuate at middle.

Length, 1 mm.

Type locality, Dubois, Ill., April 24, 1914 (C. A. Hart and J. R. Malloch).

A male taken at the same time and place may belong to this species. It resembles very closely the male of *lasiops*, but differs in being smaller and in having the posterior branch of the cubitus more abruptly bent and the distance from cross vein to apex of first shorter in comparison with the distance from apex of first to apex of third.

3. Camptocladius byssinus Schrank

Tipula byssinus Schrank, Fauna Boica, Vol. 3, 1803, p. 2330, sp. 76.

Chironomus byssinus (Schrank) Meigen, Syst. Beschr. Eur. Zweifl. Ins., Vol. 1, 1818, p. 58.

Camptocladius byssinus (Schrank) Van der Wulp, Tijdschr. v. Ent., Vol. 17, 1874, p. 133.

Male.—Deep velvety black, disc of thorax slightly shining. Head black, antennal plumes black at bases, whitish apically. Legs black, bases of tarsi yellowish. Wings milky, a longitudinal black streak on base, veins colorless. Halteres black. Hairs on body and legs whitish.

Head very similar to that of *lasiops* except that the eyes are bare. Pronotum narrow. Hypopygium as in Figure 11, Plate XL. Basal

joint of fore tarsi slightly less than half as long as fore tibiæ (12 : 25); mid and hind legs with moderately long hairs; empodium about as long as claws, distinctly fringed. Venation as in Figure 9, Plate XXXV.

Female.—Agrees with the male in coloration except that the wings have a slight yellowish reflection and the veins are more distinct. Apical segments of abdomen as in Figure 17, Plate XXXVIII.

Joints of flagellum of antenna about as broad as long, with broad leaflike sensory organs (Pl. XXXVIII, Fig. 11), basal and second joints distinctly separated. Wings differ from those of the male in having the third and costal veins very closely approximated for some distance before the apex of latter and continued beyond beginning of apical curve of wing.

Length, 1.5–2.5 mm.

Illinois localities: Muncie, Urbana, St. Joseph, Rock Island, Havana, Grand Tower, Normal, on dates ranging from April 24 to October 21.

Although this species has been reared by other workers from dung, no description of the larva has been published.

Originally described from Europe and recorded from Greenland, Alaska, Washington State, New Jersey, and New York.

Females labeled as *aterrimus* in the collection of the U. S. Bureau of Biological Survey from Washington, D. C., are *byssinus*.

4. Camptocladius aterrimus Meigen ?

Chironomus aterrimus Meigen, Syst. Beschr. Eur. Zweifl. Ins., Vol. 1, 1818, p. 59.

Camptocladius aterrimus (Meigen) Van der Wulp, Tijdschr. v. Ent., Vol. 17, 1874, p. 133.

Male.—Closely resembles *subaterrimus*, n. sp., described on later page, in color and structure, but differs in the structure of the hypopygium (Pl. XL, Fig. 9) and in the comparative lengths of the basal joint of fore tarsi and fore tibiæ (21 : 34). Wing as in Figure 8, Plate XXXIX.

Female.—Unrecognized.

Length, 2.5–3 mm.

Illinois localities: Carmi, April 15, 1914, on bank of little Wabash River, and Rattlesnake Ferry—Big Muddy River—near Grand Tower, April 22, 1914 (C. A. Hart and J. R. Malloch).

I have provisionally considered this species as *aterrimus*, since it agrees with Johannsen's description of that species and is probably

the insect he thus identified, though I have doubts as to the identity of our *aterrimus* with that recorded from Europe. Lundbeck is responsible for a record of its occurrence in Greenland, while Johannsen records it from Michigan and New Jersey. I have not seen European examples.

The early stages are undescribed.

5. Camptocladius flavens, n. sp.

Male.—Greenish yellow, subopaque. Mesonotum rarely with indications of pale brownish vittæ. Wings whitish, veins colorless.

Palpi 4-jointed; apical flagellar joint distinctly, but not greatly, longer than the other flagellar joints combined. Pronotum of moderate breadth, without central dorsal excision. Hypopygium as in Figure 15, Plate XXXVI, and Figure 5, Plate XL. Legs rather stout; fore tarsi without long hairs, basal joint about half as long as fore tibiæ (21 : 40); mid and hind legs with long hairs. Third vein ending beyond beginning of apical curve of wing and very slightly in front of apex of upper branch of cubitus; costa extending distinctly beyond apex of third vein; distance from cross vein to apex of first distinctly less than that from apex of first to apex of third (19 : 25); cubitus forking very slightly beyond cross vein, posterior branch distinctly bisinuate (Pl. XXXIX, Fig. 16).

Female.—Agrees in color with the male except that the apical antennal joint is brown.

Palpi as in Figure 12, Plate XXXVIII; antennal flagellum has the joints much longer than their diameter, the basal two closely fused, and the sensory organs hairlike (Pl. XXXVIII, Fig. 14). Apex of abdomen as in Figure 16, Plate XXXVIII.

Length, 2–3 mm.

Type locality, Havana, Ill., April 29, 1914, on Illinois River (C. A. Hart and J. R. Malloch). Paratypes: St. Joseph, Ill., May 17, 1914, on bank of Salt Fork (C. A. Hart and J. R. Malloch), and South Haven, Mich., July 14, 1914, on shore of Lake Michigan (Hart).

This species differs in color from *C. fumidus* Johannsen, and from *C. graminicola* Lundbeck, a Greenland species, in having the wings bare.

6. Camptocladius flavibasis, n. sp.

Female.—Brownish black, slightly shining. Head fuscous, face, antennæ, and palpi yellowish brown. Pronotum, anterior lateral angles of mesonotum, and upper portion of pleuræ yellowish. Abdomen brownish black, opaque, yellowish at base and on venter. Legs brown-

ish yellow, trochanters and bases of femora pale yellow. Wings slightly grayish, veins brown, base of wing, including bases of veins, whitish yellow. Halteres yellow, knobs brown. Body hairs pale brown.

Flagellar joints elongate, basal 2 fused, sensory organs hairlike. Pronotum of moderate breadth, without central dorsal excision. Disc of mesonotum (between the vittæ) and of scutellum with long sparse hairs; posterior half of the former with pale pruinescence. Legs rather stout; basal joint of fore tarsi half as long as fore tibiæ; empodium about as long as claws, distinctly fringed. Third vein ending very slightly beyond beginning of apical curve of wing and nearly in line with apex of upper branch of cubitus; cross vein distinctly before wing-middle, slightly acute; cubitus forking distinctly beyond cross vein, its posterior branch slightly bisinuate.

Length, 1.25 mm.

Type locality, Urbana, Ill., August 23, 1914, on window (C. A. Hart and J. R. Malloch).

7. Camptocladius subaterrimus, n. sp.

Male.—Black, subopaque. Antennæ and their plumes fuscous. Mesonotum yellowish between the vittæ and on lateral anterior angles; upper central portion of pleuræ yellow. Abdomen black. Legs slender, fuscous, tibiæ and tarsi yellowish brown. Wings clear, veins brown but black at base. Halteres yellowish brown. Body hairs brown.

Pronotum of moderate breadth, central dorsal excision weak. Hypopygium as in Figure 3, Plate XL. Legs very slender; fore tarsi without long hairs, basal joint slightly more than half as long as fore tibiæ (16: 28); mid and hind legs with long hairs; empodium distinct, rather densely fringed. Wing venation almost identical with that of *aterrimus*.

Length, 2.5 mm.

Type locality, Grand Tower, Ill., April 21, 1914, on bank of Mississippi River (C. A. Hart and J. R. Malloch).

Orthocladius Van der Wulp, sens. lat.

This genus as defined by Van der Wulp contained a very large number of species which were very closely allied. Subsequent workers on the family have discovered many minute characters that were either overlooked or ignored by the older authors, and many of these have been used as a basis for the division of the old genus *Orthocladius* into subgenera. Kieffer, who is responsible for the subdivisions

referred to, ranked them as subgenera, but in his recent papers on the group he has raised them to generic rank. It is the opinion of the writer that our knowledge of the early stages and adult habits of this group is entirely too meager for an understanding of existing generic relations, and pending further life-history data the current subdivisions are here accepted without either admitting or questioning their validity. The characters used are rather obscure, difficult to appreciate, and in other families would not generally be considered as of primary importance; but owing to the scarcity of outstanding structural characters it is essential that importance should be given to even minute details provided they are constant in form. In the use of characters for subgeneric separation the present writer confines himself to those which are possessed by both sexes in common, or to such male characters as are in coordination with characters possessed by the other sex. The erection of a genus for the reception of males with certain hypopygial or antennal characters without reference to the characters by means of which females may be assigned to the genus is not conducive to a better understanding of the group, nor does it facilitate the work of identification but, rather, retards it, and should be avoided. The writer hopes at some future time to deal with the species of this group in a more detailed manner.

Key to Subgenera (After Kieffer)

1. Eyes with short hairs....2
— Eyes bare....3
2. Palpi with 4 joints....*Trichocladius* (p. 514)
— Palpi with 3 joints....*Diplocladius**
3. Pulvilli large....*Psectrocladius* (p. 519)
— Pulvilli absent....4
4. Empodium indistinct....*Orthocladius* (p. 521)
— Empodium filiform....5
5. Palpi with 4 joints....*Dactylocladius* (p. 526)
— Palpi with 3 joints....*Trissocladius**

The members of the genus *Cricotopus* have hairs on the eyes, and are rather arbitrarily separated from those of *Trichocladius* by the color of the legs. Kieffer, in 1913†, based his separation of the two genera on the presence or absence of pulvilli. *Cricotopus* is stated to have large pulvilli, but in the species before me it is very difficult to see them, and unless under high magnification with good light they are

*Unknown to me.

†Rec. Ind. Mus., Vol. 9, p. 123.

invisible.* *Camptocladius* is separable from *Orthocladius,* sens. lat., as indicated in the generic key to *Chironomincæ,* by the course of the posterior branch of the cubitus; but this is variable, and occasionally it is doubtful to which genus a species belongs.

I include in this paper only species belonging to the State Laboratory collection, which represents but a small portion of those occurring in North America.

Trichocladius Kieffer

Johannsen has described one North American species belonging to this division, *lactipennis,*† and in the same paper assigns *politus* Coquillett to it. In a previous paper‡ he states that several North American species of *Orthocladius* have hairy eyes, but does not give the names of the species. Some species included in *Camptocladius* in this paper have hairy eyes.

I have included in my key only the species that are represented in the State Laboratory collection, the early stages of which are unknown to me.

Key to Species

1. Thorax glossy black, without pale markings; halteres black....2
— Thorax either yellow with dark vittæ or opaque black; halteres pale 3
2. Scutellum opaque, velvety black.....1. *nitidus.*
— Scutellum shining black.....2. *nitidellus.*
3. Thorax in both sexes glossy, bright yellow, the vittæ glossy black; basal joint of fore tarsi three fourths as long as fore tibiæ..... .....3. *politus.*
— Thorax black or obscurely yellowish between the vittæ or on the lateral margins; basal joint of fore tarsi less than three fourths as long as fore tibiæ.....4
4. Large species, 3 mm. in length; thorax of male glossy, the ground color yellow much suffused with fuscous.....5
— Smaller species, 1–2 mm. in length; thorax of male opaque black, generally with yellow lateral margins and faint indications of yellow marks between the vittæ; thorax of female yellow with reddish or blackish vittæ.....6
5. Third vein ending as far in front of wing-apex as upper branch of cubitus does behind it.....4. *infuscatus.*
— Third vein ending at less distance in front of wing-apex than upper branch of cubitus does behind it.....5. *striatus.*

**Trichocladius nitidus,* described in this paper, has distinct pulvilli, and except in having unicolorous legs resembles *Cricotopus* closely.

†Bull. 124 (1908), N. Y. State Mus., p. 282.

‡Ent. News, Vol. 18, 1907, p. 400.

6. Femora entirely yellow; posterior half of fifth and sixth dorsal abdominal segments yellow, the remainder velvety black.....
.....6. *distinctus.*
— Femora blackened on bases.....7
7. Abdomen of male black, that of female with narrow pale posterior margins to segments.....*distinctus,* var. *basalis.*
— Abdomen of male whitish or yellowish, blackened at apex.....
.....*distinctus,* var. *bicolor.*

1. Trichocladius nitidus, n. sp.

Male.—Black. Head glossy black, scape of antennæ concolorous, flagellum, plumes, and palpi fuscous. Thorax entirely black and highly polished; scutellum velvety black. Abdomen velvety black with slight indication of pale posterior margins to apical three segments. Legs black, tibiæ and tarsi brownish black. Wings clear, veins at base blackened, first and third brown, the others pale. Halteres black. Hairs on body and legs brown.

Pronotum narrow. Hypopygium as in Figure 7, Plate XL. Legs slender; fore tarsi without long hairs, basal joint three fifths as long as tibia; hairs on mid and hind tibiæ not much longer than the diameter of the tibiæ. Third vein ends distinctly but not greatly in front of wing-apex; distance from cross vein to apex of first slightly less than distance from the latter to apex of third; cubitus forks almost directly below cross vein, its posterior branch almost straight (Pl. XXXIX, Fig. 14).

Length, 2 mm.

Type locality, Monticello, Ill., June 28, 1914 (C. A. Hart and J. R. Malloch).

Early stages unknown.

2. Trichocladius nitidellus, n. sp.

Male.—Glossy black. Head, including the antennæ and their plumes, black, clypeus yellowish. Pronotum and upper central portion of pleuræ brownish, remainder of thorax glossy black; disc of mesonotum without pruinescence. Abdomen entirely shining black. Legs tawny yellow, femora and apices of tarsi brownish. Wings clear, veins almost colorless except at base. Halteres brown.

Apical joint of antenna about twice as long as the other flagellar joints combined. Hypopygium similar to that of *Camptocladius flavens,* the apex of apical portion of lateral arm with a rather slender thorn situated in a rounded hollow. Legs moderately stout; fore tarsi without long hairs, basal joint slightly more than half as long as fore

tibiæ (25 : 40), hairs on mid and hind legs short; empodium distinct, fringed. Third vein ending just beyond beginning of apical curve of wing; costal vein not projecting beyond apex of third; the cell enclosed by third vein and costal broad to apex; distance from cross vein to apex of first subequal to that from apex of first to apex of third; cubitus forking appreciably beyond cross vein.

Length, 3.5 mm.

Type locality, St. Joseph, Ill., May 17, 1914, on bank of Salt Fork (C. A. Hart and J. R. Malloch).

3. Trichocladius politus Coquillett

Orthocladius politus Coquillett, Proc. U. S. Nat. Mus., Vol. 25, 1902, p. 93.
Trichocladius politus (Coquillett) Johannsen, Bull. 124 (1908), N. Y. State Mus., p. 283.

Male.—Head yellow, antennæ and palpi fuscous, base of flagellum yellowish, plumes brown. Thorax glossy yellow, vittæ, a spot in front of and below wing-base, the greater part of sternopleura and of postnotum glossy black. Abdomen brownish or fuscous, the anterior portions of basal two or three segments yellowish. Legs yellow, mid and hind coxæ, all femora except at their bases, the apices of tibiæ and of first three tarsal joints blackened, fore tibiæ and tarsi and apical two joints of mid and hind tarsi generally brownish. Wings clear, veins brown. Halteres clear yellow.

Antenna about 1.5 times as long as head and thorax together; apical joint of palpi distinctly longer than subapical. Pronotum narrowed towards its upper extremity, central excision deep and broad. Hypopygium as in Figure 9, Plate XXXVII. Legs slender; fore tarsi without long hairs, basal joint nearly three fourths as long as fore tibiæ (30 : 43); mid and hind legs with distinct, though not long, surface hairs; all tarsal claws digitate apically (Pl. XXXII, Fig. 9); pulvilli indistinct; empodium present. Third vein ending beyond beginning of apical curve of wing, the cell enclosed by it broad and distinct to apex; cross vein at wing-middle, almost upright, cubitus forking below cross vein.

Female.—Agrees in color with the male.

The scape of the antennæ is enlarged, the flagellum consists of six joints, the basal two being closely fused and appearing as one, the length of this composite joint being slightly less than that of the next two joints combined (15 : 18), the apical joint is much longer than the others, the comparative lengths of apical and subapical joints being as 21 to 8; sensory antennal organs slender, hairlike, placed near apices of the joints; apical joint of palpi distinctly longer than sub-

apical, the lengths of the joints from base to apex being respectively as 10, 15, 20, 38. In other respects closely resembles the male.

Length, 2.5–3 mm.

Illinois locality, Momence, July 17, 1914, at light (C. A. Hart).

Originally described from a male taken at Washington, D. C. Recorded from New Jersey. I have seen examples taken on Plummer's Island, Md., and at Washington, D. C., in August and October (W. L. McAtee).

Early stages unknown.

4. Trichocladius infuscatus, n. sp.

Male.—Head yellow; antennæ fuscous, scape glossy black, plumes fuscous; palpi brownish. Thorax glossy black, pronotum, lateral margins of mesonotum, the spaces between the vittæ, and a small portion of upper part of mesopleura yellowish; scutellum brown; postnotum black. Abdomen black, venter and apices of the last two or three dorsal segments greenish. Legs fuscous, fore coxæ, trochanters, and base of all femora, mid and hind tibiæ and bases of their tarsi greenish yellow; fore tibiæ and tarsi almost unicolorous fuscous. Wings clear, veins pale brown. Halteres yellow.

Frontal tubercles absent; antenna about one and a third times as long as head and thorax combined. Pronotum of moderate breadth. Hypopygium as in Figure 7, Plate XXXVII. Legs slender; fore tarsi without long hairs, basal joint almost three fifths as long as fore tibiæ (21 : 36); hairs on mid and hind legs barely longer than diameter of the joints which bear them. Third vein ending at about the same distance in front of wing-apex as upper branch of cubitus does behind it (Pl. XXXIX, Fig. 2); cross vein distinctly but not greatly in front of middle of wing; cubitus forking very slightly beyond cross vein.

Length, 3.25 mm.

Type locality, Peoria, Ill., October 22, 1914, at light (C. A. Hart).

Early stages unknown.

Closely allied to *Orthocladius fugax* Johannsen, but separable by the color of the hypopygium, which is whitish in *fugax*, and several structural characters. Probably this is var. *a* of Johannsen, recorded from Ithaca, N. Y., and from Chicago.

5. Trichocladius striatus, n. sp.

Male.—Differs from *infuscatus* in being paler in color, the face, ground color of thorax, bases of femora, and the tibiæ being yellow.

Structurally it resembles *infuscatus* closely, differing principally in the form of the hypopygium as shown in Figure 10, Plate XXXVII,

and in venation, the third and fourth veins and the upper branch of cubitus ending on wing-margin as shown in Figure 3, Plate XXXIX, while the venation of *infuscatus* is as shown in Figure 2.

(The fore tarsi are absent from type.)

Length, 3 mm.

Type locality, Dubois, Ill., April 24, 1914 (C. A. Hart and J. R. Malloch).

A female taken at Muncie, May 24, 1914, by the same collectors may belong to this species. It differs from the male in being pale yellow, and in having the vittæ black, bases of abdominal dorsal segments brown, and apices of femora, of tibiæ, and of all tarsi blackish brown. The wings are slightly grayish.

The basal joint of fore tarsi is very slightly over half as long as fore tibiæ (16: 30), and the venation is similar to that of male at apex of wing, though the first vein ends less than midway from cross vein to apex of third.

6. Trichocladius distinctus, n. sp.

Male.—Black, opaque. Head yellow, antennæ black, plumes fuscous, whitish at tips. Thorax usually opaque black, with lateral margins, the spaces between the vittæ, and the upper margin of pleuræ yellow, but rarely yellow with the black areas much restricted. Abdomen velvety black, hypopygium, posterior half of dorsal segments 5 and 6, and the basal two segments and the lateral margins of the other ventral segments yellow. Legs yellow, coxæ, extreme apices of tibiæ, and apical joint of tarsi blackened. Wings whitish, veins colorless. Halteres yellow.

Antenna slightly longer than head and thorax together. Pronotum of moderate width; mesonotum not produced much in front. Hypopygium as in Figure 5, Plate XXXVII. Legs rather stout; fore tarsi without long hairs, basal joint three fifths as long as fore tibiæ; mid and hind legs with moderately long hairs; all tibiæ with distinct spurs. Third vein ending almost directly above the point where the anterior branch of cubitus reaches the wing-margin; cross vein distinctly in front of wing-middle; cubitus forking slightly beyond cross vein; none of the veins dilated.

Female.—Differs from the male in being much paler in color; the thorax is yellow, with the vittæ, a large portion of sternopleura, a spot in front of wing-base, and the greater portion of the postnotum opaque black. The dorsum of the abdomen is opaque black, the segments having very narrow pale posterior margins except the apical

three, which have rather broad, pale posterior bands. In other respects very similar to the male.

The legs are less distinctly haired than those of the male, the cross vein is nearer to the base of the wing, and the apical portion of first and third veins are distinctly dilated.

Length, 1.75–2 mm.

Type locality, Havana, Ill., taken in numbers at rest upon trees and buildings at Chautauqua Park on the bank of the Illinois River (C. A. Hart and J. R. Malloch).

Early stages unknown.

Var. *basalis*, n. var.

Male.—This variety differs from the type in being slightly smaller, 1.25–1.5 mm., and in having the bases of all the femora blackened. In some specimens the black covers the greater part of the femora, this being most noticeable on the fore pair. The pale margins of the fifth and sixth abdominal segments are either indistinct or absent.

Female.—Differs from the male in the same manner as the type. The vittæ are occasionally but little darker than the ground color of the thorax.

Type locality, Havana, April 28–30, 1914, along the shore of the Illinois River. Paratypes from the following Illinois localities, all taken during 1914: Big Muddy River near Grand Tower, April 22; Peoria, October 22; Rock Island, October 21; Muncie, May 24, on Stony Creek; St. Joseph, May 31,—(C. A. Hart and J. R. Malloch).

Early stages unknown.

Var. *bicolor*, n. var.

Two specimens which agree with variety *basalis* in size and color of legs differ in the color of the abdomen, the basal half being white and the pale margins of fifth and sixth segments very broad. The hypopygium is slightly different also (Pl. XXXVII, Fig. 6).

Type locality, St. Joseph, Ill., May 3, 1914 (J. R. Malloch).

It is possible that this is a distinct species, but more specimens are requisite to render an opinion advisable.

Psectrocladius Kieffer

The species in this division, as far as my present material indicates, are generally much paler than those of *Orthocladius*, and in this respect resemble most of those of *Trichocladius*, differing from the

latter in having the eyes bare. The distinction between *Orthocladius* and *Psectrocladius* lies in the absence of pulvilli and empodia in the former and their presence in the latter. It is a rather unsatisfactory character, but still an appreciable one, and seems to be coordinated with the difference in color.

The early stages are not known.

Key to Species

1. Very small species, not exceeding 1 mm. in length; venation as in Figure 7, Plate XXXIX.....1. *sordens.*
— Larger species, over 2 mm. in length.....2. *vernalis.*

1. Psectrocladius sordens Johannsen

Orthocladius sordens Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 272.

Female.—Yellow, opaque. Head yellow, apical joint of antennæ and the palpi subfuscous. Mesonotum with three brown vittæ; sternopleura and a spot slightly in front of wing-base brown; scutellum yellow; postnotum dark brown. Abdomen with a median fuscous fascia, which is generally rather broad and occasionally extends to apex of abdomen. Legs and halteres yellow. Wings clear, veins pale yellow.

Pronotum distinct, not broad, linear on upper third and discontinued distinctly before upper margin of mesonotum, the latter slightly protruding anteriorly. Fore tarsi with basal joint half as long as tibia (5: 10), fourth tarsal joint of all legs shorter than fifth. Third vein not reaching beyond beginning of apical curve; cross vein oblique, one third from wing-base; cubitus forking distinctly beyond cross vein, posterior branch sinuate. (Pl. XXXIX, Fig. 7.)

Length, .75–1 mm.

Illinois locality, Urbana. A large series of females taken by the writer at a State Laboratory desk-light May 4, 1914.

Originally described from Ithaca, N. Y., by Johannsen, who suggested at the time that two mutilated specimens from South Dakota which he had before him might also belong to this species.

The male and early stages are undescribed.

2. Psectrocladius vernalis, n. sp.

Male.—Yellow, slightly shining. Head yellow; scape of antennæ black, flagellum brown, yellowish at base, plumes brownish, paler at bases; palpi fuscous at apices. Mesonotum with shining brownish black vittæ, pleural spots and pronotum black or brownish black. Abdomen brown, hypopygium yellowish. Legs yellow; apices of tarsi

slightly browned; mid and hind tibiæ with the usual black apical comb. Wings clear, veins colorless. Halteres yellow.

Eyes bare; antenna slightly longer than head and thorax combined; palpi 4-jointed. Hypopygium as in Figure 14, Plate XXXVII. Legs moderately stout; fore tarsi without long hairs, basal joint five sevenths as long as fore tibiæ; pulvilli and empodia large; mid and hind legs with short hairs. Third vein straight, ending slightly beyond beginning of apical curve of wing and directly above apex of upper branch of cubitus; cross vein slightly before middle of wing, and distinctly, though not greatly, in front of fork of cubitus; posterior branch of cubitus nearly straight; distance from cross vein to apex of first subequal to that from apex of first to apex of third; second vein (R_2) distinct.

Length, 3.25 mm.

Type locality, Dubois, Ill., April 24, 1914 (C. A. Hart and J. R. Malloch).

Differs from *sordens* in venation and color particularly.

Orthocladius Van der Wulp, sens. stric.

Only a few North American species are left in the genus *Orthocladius* as restricted by Kieffer, and these, as far as our Illinois species are concerned, are of an almost unicolorous black except in the females, which occasionally have the ground color of the thorax yellowish. In addition to this almost constant unicolorous character the species are so very similar in structural details that at times one is doubtful as to whether the slight differences are those between individuals of a single species or distinctions that are of specific importance. I have divided the species before me upon the characters given in the synoptic key, and believe that those selected are really of specific value, though difficult to distinguish. The empodia, when present, are always very small—a character that readily separates the species from *Camptocladius*.

Key to Species in Collection (Males)

1. Wing with cross vein subparallel with first vein (Pl. XXXIX, Fig. 12); basal portion of lateral arm of hypopygium with poorly developed process on inner side.....1. *subparallelus.*
— Wing with cross vein almost at right angles to first vein (Pl. XXXIX, Fig. 11); or basal portion of lateral arm of hypopygium with well-developed process on inner side.....2
2. Fore tarsi with dense and very long hairs.....2. *pilipes.*
— Fore tarsi with at most sparse hairs which are, except in *nivoriundus*, but little longer than the joints which bear them.....3

3. Scutellum yellow, remainder of thorax black; cross vein not at right angles to first vein (Pl. XXXIX, Fig. 13); apical portion of lateral arm of hypopygium as in Figure 10, Plate XL.....
.....3. *flavoscutellatus.*
— Scutellum concolorous with mesonotum, or but little paler; cross vein almost at right angles to first vein.....4
4. Halteres pale yellow.....5
— Halteres brown or blackish.....6
5. Basal joint of fore tarsi nearly three fourths as long as fore tibiæ (26:35) .....4. *lacteipennis.*
— Basal joint of fore tarsi two thirds as long as fore tibiæ.....
.....5. *obumbratus.*
6. Basal joint of fore tarsi about four fifths as long as fore tibiæ; hypopygium as in Figure 3, Plate XXXVII.....6. *nigritus.*
— Basal joint of fore tarsi distinctly less than four fifths as long as fore tibiæ.....7. *nivoriundus.*

1. Orthocladius subparallelus, n. sp.

Male.—Black, slightly shining. Head, including antennæ and their plumes, fuscous. Thorax black, disc shining, the membranous portion of pleuræ brownish yellow. Legs fuscous, tibiæ and tarsi pale brown. Wings slightly grayish, veins brown. Halteres fuscous.

Eyes bare; palpi 4-jointed. Pronotum of moderate breadth throughout, central dorsal excision broad and distinct; mesonotum with few discal hairs. Hypopygium as in Figure 6, Plate XL, the projection on inner side of basal portion of lateral arm very weak. Legs slender; fore tarsi without long hairs, basal joint slightly more than half as long as fore tibiæ (18:33); mid and hind legs with moderately long fine hairs. Third vein ending much in front of apex of wing; cross vein subparallel with first (Pl. XXXIX, Fig. 12); cubitus forking very slightly beyond apex of cross vein.

Length, 2.5 mm.

Type locality, Grand Tower, Ill., April 21, 1914, on bank of Mississippi River (C. A. Hart and J. R. Malloch).

Female and early stages unknown.

2. Orthocladius pilipes, n. sp.

Male.—Differs in color from *subparallelus* in being less intensely black, and in having distinct grayish pruinescence between the thoracic vittæ, and the tibiæ but little paler than the femora.

The pronotum is broad, with a narrow but distinct central dorsal excision, and the disc of mesonotum has sparse long hairs. Hypopygium as in Figure 8, Plate XXXVII. Fore tarsi with very long

and dense hairs, the length of those on the apical half of basal joint at least equal to the length of fourth joint, basal joint over two thirds as long as fore tibiæ (40:55); mid and hind legs with long hairs. Third vein ending beyond beginning of apical curve of wing, but distinctly in front of wing-apex; distance from cross vein to apex of first slightly exceeding distance from latter to apex of third; cross vein (Pl. XXXIX, Fig. 11) slightly sloping; cubitus forking below cross vein.

Length, 3.5–4.5 mm.

Type locality, Urbana, Ill., March 21, 1889, swarming about evergreens (John Marten).

Female and early stages unknown.

This species bears a strong resemblance to *pubitarsis* Zetterstedt, which has been recorded from Greenland by Lundbeck. It differs from the description of that species in having dark halteres, and the basal joint of fore tarsi distinctly shorter than fore tibiæ. *Barbicornis* Linné is described as having the fore femora and tibiæ with long hairs and the fore tarsi short-haired. In *pilipes* there are no long hairs on the femora and tibiæ, while the tarsal hairs are very long and dense. Johannsen describes *barbicornis* as having long hairs on femora and tibiæ, and Schiner's description also leads one to infer that, contrary to the general rule, the fore legs are uniformly hairy, which is not the case in the species before me. In view of these facts I have no hesitation in describing the species as new.

3. Orthocladius flavoscutellatus, n. sp.

Male.—Black, shining. Head brownish; antennæ and their plumes fuscous; palpi fuscous, yellowish at base. Thorax black, disc glossy, areas between vittæ slightly paler than vittæ and with sparse pale pruinescence; upper central portion of pleuræ brownish; scutellum yellow; postnotum black. Abdomen brownish black, shining. Legs brownish yellow, bases of femora and the trochanters clear yellow, femora towards apices darker than other portions of legs. Wings clear, veins pale. Halteres yellow. Thoracic and abdominal hairs yellow.

Second joint of palpi with a prolongation at tip, which is about as long as diameter of joint at insertion of third. Mesonotum with rather sparse long hairs between the vittæ. Hypopygium as in Figure 10, Plate XL. Legs slender, without long hairs; basal joint of fore tarsi very slightly exceeding half the length of fore tibiæ (15:28); empodium very weak. Third vein ending at beginning of apical curve of wing, costa extending slightly beyond apex of third; distance from apex of cross vein to apex of first subequal to that from apex of first

to apex of third, cross vein as in Figure 13, Plate XXXIX; cubitus forking distinctly, but not greatly, beyond apex of cross vein.

Length, 2 mm.

Type locality, Muncie, Ill., May 24, 1914; swept from vegetation on bank of Stony Creek (C. A. Hart and J. R. Malloch).

Female and early stages unknown.

4. Orthocladius lacteipennis, n. sp.

Male.—Black, slightly shining. Head yellowish; antennæ, including the plumes, black; palpi fuscous. Pronotum yellowish; mesonotum black, yellowish on anterior lateral angles, disc with whitish pruinescence which is distinct only when viewed from behind; upper portion of pleuræ yellowish centrally, the remainder, as well as scutellum and postnotum, subshining black. Abdomen black, slightly shining, posterior margins of last two segments narrowly pale. Legs fuscous, tibiæ and tarsi paler. Wings whitish, veins almost colorless, the thickened portion at base blackened. Halteres pale yellow.

Antenna equal to length of head and thorax together. Pronotum rather broad and of equal width throughout. Hypopygium similar to that of *pilipes*, the extension of dorsal plate of moderate length, tapering, armed with numerous hairs; appendage on inner surface of basal portion of lateral arm of moderate size, rounded; apical portion of lateral arm very like that of *nivoriundus*. Fore tarsi without long hairs, basal joint about three fourths as long as fore tibiæ (26: 35); fifth joint five sixths as long as fourth; empodium distinguishable, but shorter than claws and very slender; mid and hind legs with short hairs. Third vein almost straight, extending beyond beginning of apical curve of wing; cubitus forking directly below cross vein.

Length, 2.5 mm.

Type locality, South Haven, Mich., July 14, 1914, on shore of Lake Michigan (C. A. Hart).

Female and early stages unknown.

5. Orthocladius obumbratus Johannsen

Orthocladius obumbratus Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 281.

This species differs from *lacteipennis* in being slightly larger, and in having the wings and halteres slightly brownish and the basal joint of the fore tarsi two thirds as long as the fore tibiæ. The hypopygia of the species of *Orthocladius* are almost identical; in fact, throughout the whole genus these organs show but little variation.

Length, 3 mm.

Locality, Ithaca, N. Y., April, 1902 (O. A. Johannsen).

I have not seen this species from Illinois.

6. Orthocladius nigritus, n. sp.

Differs from the foregoing in having the basal joint of the fore tarsi four fifths as long as the fore tibiæ, the hypopygium as in Figure 3, Plate XXXVII, and the halteres brown or black. In other respects very similar to both *obumbratus* and *nivoriundus*.

Length, 2.5–3 mm.

Type locality, Cabin John, Md., Feb. 16, 1913 (W. D. Appel).

Type in collection of U. S. Bureau of Biological Survey. Paratypes in collection of Illinois State Laboratory of Natural History.

7. Orthocladius nivoriundus Fitch

Chironomus nivoriundus Fitch, Winter Insects of Eastern New York, p. 274. 1846.
Orthocladius nivoriundus (Fitch) Johannsen, Bull. 86, N. Y. State Mus., 1905, p. 274.

Larva.—Length, 8–9 mm. Brownish yellow. Antennæ of moderate length, not over one third as long as head, basal joint about five times as long as its diameter, second joint about one fifth as long as basal and subequal to remaining joints taken together; eye spots indistinguishable in cast skin; labium as in Figure 16, Plate XXIX; mandibles each with three distinct teeth; anal tufts each consisting of about twelve hairs, basal papillæ about twice as long as their diameter; dorsal blood-gills well developed; anterior pseudopods with many soft, dark apical hairs and numerous short preapical setulæ; posterior pseudopods with the apical hairs clawlike.

Pupa.—Length, 6–7 mm. Brown. Thoracic respiratory organs as in Figure 1, Plate XXXVIII; abdominal segments 2–6 with the disc, except the lateral and extreme anterior margins, covered with very small setulæ (Fig. 9), those on the sixth segment being in groups of two to four, and those on the other segments occurring singly; segments 2–7 each with four brownish spots, one near each antero-lateral angle and one on each side of the median line about one third from the posterior margin; second segment without posterior transverse row of strong setulæ; eighth segment as in Figure 5, Plate XXXVIII; apical abdominal appendages with moderately long lateral fringe and three long apical hairs (Fig. 3).

Imago; Male.—Agrees in color with *nigritus*, differing principally in the comparative lengths of the basal joint of the fore tarsi and fore tibiæ and in the structure of the hypopygium (Pl. XXXVII, Fig. 12).

Length, 3–4 mm.

Illinois localities: Illinois River at Havana; Homer and St. Joseph; Dubois and Parker.

Originally described from New York. A species recorded from Gallinas River, Las Vegas, N. M., by Johannsen, is stated to differ in size—both larva and imago—from *nivoriundus,* and Johannsen suggests that it may be a distinct species.

The larval labium figured for this species by Johannsen does not agree with that of the larvæ I reared, as will be seen by comparison of his figure with mine, but the pupa agrees entirely with the description given by him. One pupal specimen differs from the typical form in having the thoracic respiratory organs as in Figure 2, Plate XXXVIII, and the eighth abdominal segment as in Figure 4. This may be a distinct species, but I have reared only one female specimen and can find no good character for separating it from the female of *nivoriundus.*

Dactylocladius Kieffer

This division, or subgenus, includes species which are distinguished from *Orthocladius* by the presence of linear empodia. It is seldom that the empodium is indistinguishable under a high-power lens, but it is very small. In the species which I have referred to *Dactylocladius* the empodium is longer than the claws. There are in *brevinervis* other differences in structure which might be considered as of equal value for the separation of at least the males of the two species here dealt with, but the generic characters of *Dactylocladius* have not been indicated sufficiently by Kieffer, and as the type species may possess the characters of either *brevinervis* or *pleuralis* I am unable to utilize them in limiting the group.

Key to Species

1. Third vein ending noticeably proximad of apex of anterior branch of cubitus; second vein indistinguishable.....1. *brevinervis.*
— Third vein ending distad of apex of anterior branch of cubitus or very little proximad of it; second vein distinct.....2
2. Yellow species, general color of thorax pale yellow, contrasting markedly with the blackish vittæ.....2. *pleuralis.*
— Black species, ground color of thorax blackish..3. *albidohalteralis.*

1. Dactylocladius brevinervis, n. sp.

Male.—Black, shining. Head yellowish, antennæ and palpi fuscous. Mesonotum distinctly shining, spaces between the vittæ ochreous; pleuræ dull yellow; scutellum obscurely yellowish; postnotum black. Abdomen black, without pale markings. Legs obscurely yellowish, fore femora slightly brownish. Wings clear, veins very pale. Halteres yellow.

Palpi 4-jointed. Mesonotum and abdomen with sparse hairs. Hypopygium as in Figure 12, Plate XL. Legs slender, mid and hind pairs with moderately long hairs; fore tarsi with basal joint nearly three fourths as long as fore tibiæ (14:20); hind tibia with two long apical spurs; fourth joint of hind tarsus very slightly longer than fifth; tarsal claw long, curved, digitate apically; empodium long, distinctly fringed. Third vein ending considerably in front of apex of wing (Pl. XXXIX, Fig. 5); second vein (R_2) indistinguishable.

Length, 1.75–2.5 mm.

Type locality, Muncie, Ill., May 24, 1914; swept from vegetation on bank of Stony Creek (C. A. Hart and J. R. Malloch). Paratypes from Peoria, April 10, 1912, on a small creek; and from Havana, Ill., April 22, 1898, at light, mouth of Spoon River (C. A. Hart).

The absence of the second vein (R_2) distinguishes the species readily from any other in the genus *Orthocladius* which I have seen. It may not really be congeneric with the genotype of *Dactylocladius;* I am unable to decide from the description given by Kieffer. The paratypes differ from the type in having the ground color of the thorax fuscous.

2. Dactylocladius pleuralis, n. sp.

Male.—Bright yellow, shining. Head yellow; antennæ and their plumes entirely fuscous; palpi yellow, apical half infuscated. Mesonotum clear yellow, the vittæ brownish black, shining, clearly defined, no distinct division of the middle vitta; sternopleura black with the exception of the upper posterior angle, and also a small black spot slightly below and in front of wing-base; scutellum clear yellow; postnotum black, slightly yellowish at base. Abdomen shining black, base of first segment and hypopygium yellowish. Legs yellow, apices of fore femora, the fore tibiæ, and apices of tarsi slightly browned; mid and hind tibiæ with the normal apical black comb. Wings clear, veins almost colorless. Halteres yellow.

Pronotum extending almost to upper margin of mesonotum, without a central excision. Mesonotum with but few weak hairs. Abdomen slender, segments of almost equal length throughout; hypopygium as in Figure 13, Plate XXXVII. Legs slender; fore tarsus without long hairs, basal joint slightly more than half as long as tibia (20:35); mid and hind legs with moderately long pale surface hairs and distinct apical spurs. Cross vein slightly before middle of wing, not upright; cubitus forking distinctly beyond cross vein, the posterior branch slightly curved; second vein (R_2) distinct.

Length, 2.25 mm.

Type locality, St. Joseph, Ill., May 17, 1914, swept from vegetation on bank of Salt Fork (J. R. Malloch).

This species differs in venation from *brevinervis,* and might reasonably be considered as generically distinct. Owing to the doubt I have as to the venation of the genotype I consider it advisable to leave both species in *Dactylocladius* until I obtain information upon this point, or until some other worker supplies the necessary data.

3. Dactylocladius albidohalteralis, n. sp.

Female.—Glossy black. Head, including antennæ, fuscous. Mesonotum without pruinescence. Abdomen unicolorous black, less distinctly glossy than mesonotum. Legs whitish yellow, femora fuscous. Wings smoky, veins brown, base of wing, including the veins, whitish. Halteres yellow, knobs white.

Antenna about as long as head and thorax together, intermediate flagellar joints each about five times as long as their diameter, sensory organs weak, hairlike. Legs rather stout; basal joint of fore tarsi about half as long as fore tibiæ; fourth and fifth joints of hind tarsi subequal; empodium larger than claws, long-fringed. Third vein ending just beyond beginning of apical curve of wing, slightly sinuate, costal vein continued beyond apex of third; distance from cross vein to apex of first about half as great as that from apex of first to apex of third; second vein distinct; cubitus forking distinctly beyond cross vein.

Length, 1.25 mm.

Type locality, Monticello, Ill., June 30, 1914, on bank of Sangamon River (C. A. Hart and J. R. Malloch).

This species bears a strong resemblance to *Camptocladius flavibasis,* but is readily distinguishable by the fact that the posterior branch of the cubitus is not bisinuate.

Unidentified Larvæ and Pupæ of Chironominæ

In the collection of the State Laboratory of Natural History there are many specimens of larvæ and pupæ of *Chironominæ* which it has not been found possible to associate with imagines. Most of these specimens were obtained during the years 1912–13, when press of other work and want of facilities for rearing the larvæ prevented any attempt to secure data bearing on the specific identity of the material obtained. During 1914 several species were reared by the writer and the connection established between larva, pupa, and imago; but the species included in the subsequent part of this paper must remain in their present specifically unidentified condition until some one suc-

ceeds in rearing them and identifying them with their respective adults.

Chironomus sp. A

Pupa.—Length, 4–5 mm. Frontal tubercles small, thick. Abdominal segments 2–6 with pale, short, and rather broad dorsal setulæ, which are not distinct on posterior portion of the segments; second segment with the normal apical row of closely placed setulæ, which are rather long and pale; eighth segment with a conspicuous bifid apical lateral thorn (Pl. XXXI, Fig. 11, *a*, *b*) which varies sometimes in structure; fringe of usual apical appendages fine, closely placed, and of moderate length; a pair of unfringed apical appendages project caudad of the usual pair.

Illinois locality, Thompson's Lake, near Havana, April 27, 1914 (C. A. Hart and J. R. Malloch).

Pupal exuviæ of this species were floating on the surface of Thompson's Lake in numbers, but no example was found which contained the imago, and though the latter is probably described in this paper it is impossible to associate the two because of the very large number of species occurring on the lake when the pupa was taken.

Chironomus sp. B

Larva.—Length, 15 mm. Red? Head broad and short; eye spots small, widely separated, the space between the upper and lower spots equal to nearly three times the height of the upper one; labrum as in Figure 7, Plate XXIII; antennæ (Pl. XXX, Fig. 6) situated on slightly raised bases, basal joint more than four times as long as its diameter, the remaining joints one third as long as basal, third joint slightly less than a third as long as second, fourth subequal to third, fifth shorter than fourth; maxillary palpus as in Figure 5; mandibles without distinct teeth (Fig. 3); labial teeth truncate (Pl. XXIX, Fig. 5). Eleventh segment without ventral blood-gills; anterior and posterior pseudopods stout, the former with weak apical hairs, the latter with the normal apical claws; dorsal tufts weak, consisting of about six hairs, the basal papillæ short and inconspicuous, dorsal blood-gills large, about 2.5 times as long as their diameter.

Illinois localities: Illinois River at Havana, Hardin, Grafton, and Meredosia. Taken by dredging.

No attempt was made to rear the species.

Chironomus sp. C

Larva.—Length, 6–7 mm. Greenish, with a slight reddish tinge. Structurally this species closely resembles *digitatus*. The antennæ of

the single specimen of *digitatus* before me are broken, so that it is impossible to say whether those of species C (Pl. XXX, Fig. 2) resemble them. The labial plate and other details of the two species appear to be identical.

Pupa.—Length, 4 mm. Head as in Figure 13, Plate XXXVIII, the bifid projections conspicuous; thoracic respiratory organs terminating in numerous hairlike filaments; disc of thorax with minute setulæ; posterior margins of dorsal abdominal segments 2–6 each with a transverse row of flattened setulæ which are regularly spaced and of rather small size; close to the posterior margin of each segment on each side of the median line are two or three fine hairs in a transverse line; near each lateral margin about middle of segments is a similar single hair, and another near base on each side of median line; lateral margins of segments with a few weak, flattened hairs; apical appendages short, densely fringed with long hairs; in addition to the normal apical appendages there are two large ventral lobes, each ending in a short thornlike point, and a central projection ending in two slender rounded branches.

Localities, Havana, June 5, 1896, Ottawa, and Meredosia, on the Illinois River.

An imago reared from one of the pupæ obtained at Havana very closely resembles *fulvus* Johannsen in structure of legs and hypopygium, but Johannsen makes no mention of the extraordinary appendages on head of pupa, and the specimens before me show no spur on middle of lateral arm of eighth abdominal segment. As the reared specimen was in alcohol and in poor condition it is impossible to identify it authoritatively.

Tanytarsus sp. A

Pupa.—Length, 3–4 mm. Abdomen: second dorsal segment with very weak pale setulæ on posterior half, and the usual transverse apical series of brown thorns; third with weak dorsal setulæ similar to those on the second, and a conspicuous rounded patch of black spines on median line near base; segments 4–6 with larger, slightly transverse patches of black spines near base; apical lateral margin of eighth segment with 6–8 short spines. Thoracic respiratory organs missing.

Illinois locality, Thompson's Lake, near Havana, April 27, 1914 (C. A. Hart and J. R. Malloch).

Tanytarsus sp. B

Pupa.—Similar to the foregoing except that there is no group of black spines on the third abdominal segment.

Illinois locality, Thompson's Lake, near Havana, April 27, 1914 (C. A. Hart and J. R. Malloch).

Only pupal exuviæ of the foregoing two species were obtained.

Tanytarsus sp. C

Larva.—Length, 4–5 mm. Very like *exiguus*, but differing in form of labium (Pl. XXIX, Fig. 14).

Illinois locality, Illinois River at Havana.

May be a variety of *exiguus*.

Orthocladius sp. A

Larva.—Length, 4–5 mm. Yellowish. Head slightly more than a fourth longer than broad; eye spots distinctly separated, the upper one largest; antenna short, about equal in length to the mandible, base slightly raised, basal joint five times as long as its diameter, second joint slightly less than one third as long as basal and as long as next two joints together; labium (Pl. XXIX, Fig. 13) with the central portion pale, without teeth, lateral portions much darker, with four teeth.

Illinois locality, Illinois River at Dresden Heights, by dredging.

No attempt was made to rear the species.

Orthocladius sp. B

Larva.—Length, 6 mm. Yellowish brown. Head a third longer than wide; labium as in Figure 21, Plate XXIX. In other respects similar to *dissimilis*.

Illinois locality, Salt Fork at Homer Park, March 16, 1914 (C. A. Hart and J. R. Malloch).

Orthocladius sp. C

Larva.—Length, 5–6 mm. Yellowish. Labium as in Figure 20, Plate XXIX; mandibles with three distinct teeth. Except in the form of the labium this species closely resembles species E.

Illinois locality, Illinois River at Havana (C. A. Hart).

Orthocladius sp. D

Pupa.—Length, 4–5 mm. Yellowish brown. Thoracic respiratory organs long and slender, of nearly equal diameter throughout their entire length, surfaces without noticeable setulæ. Second ab-

dominal segment with band of strong setulæ on posterior margin consisting of three transverse series, and a less distinct transverse band of about the same width on disc of segment, separated from the posterior band by a clear space which is about equal in width to the band itself, disc anterior to the preapical band with very weak setulæ which are only visible under a high magnification; segments 3–5 with the greater part of the disc covered with setulæ except near the anterior margin, and on several oval areas, two or three of which are most conspicuous near the posterior margin, where the setulæ become rather stronger, and slightly in front of the posterior margin there is a bare transverse strip, and on the posterior margin a transverse band of very weak setulæ which are more numerous than those on second segment; sixth segment similar to fifth except that the setulæ are strongest on middle of disc instead of near posterior margin and that there is a rather noticeable group near the postero-lateral angle; each setulose segment with several weak hairs, four of which, the most distinct, being widely separated and forming a transverse line near posterior margin; lateral margin of each segment with a single weak hair near middle and another near apex which are not flattened as in other species. In other respects similar to *nivoriundus*.

Illinois locality, Thompson's Lake, near Havana, April 27, 1914 (C. A. Hart and J. R. Malloch).

Orthocladius sp. E

Larva.—This species very closely resembles species C, except that the central pale portion of the labium is simple (Pl. XXIX, Fig. 17).

Illinois localities: Illinois River at Spring Valley, Starved Rock, De Pue, and Marseilles; and Spoon River.

Genus incertus A

Several larval specimens in the collection of the State Laboratory belong to a genus which I can not definitely identify without reared material. It is possible that they belong either to *Cricotopus* or to *Orthocladius*, sens. lat.

Larva.—Length, 3.5–4.5 mm. Greenish. Head nearly twice as long as broad; eye spots separated by a short interval or confluent; antenna slightly longer than mandible, basal joint more than three times as long as its diameter, second joint about one third the length of basal and nearly as long as the next three joints taken together; mandibles with 2 very poorly defined teeth (Pl. XXX, Fig. 1); labial plate rather variable in form, generally as in Figure 15, Plate XXIX,

but occasionally the central tooth is shorter than in the figure, while the first laterals are longer and the outer short teeth are less conspicuous. The figure represents the labial plate as flattened by pressure, so that the lateral margins are more divergent than in nature. Anal pseudopods and blood-gills normal in form; anal tufts short, the basal papillæ inconspicuous.

Illinois localities: Illinois River at Hardin and Grafton, by dredging.

Genus incertus B

Several larval specimens in the collection of the State Laboratory resemble *Cricotopus trifasciatus* in having distinct hairs on the thoracic and abdominal segments, but without rearing the species I have no means of deciding whether it really belongs to *Cricotopus*.

Larva.—Length, 3.5–4 mm. Green. Head distinctly longer than broad; antennæ short, about equal in length to mandible (Pl. XXX, Fig. 11); labial plate with a very long hair on each side at base (Pl. XXIX, Fig. 23); anal segments as in Figure 7, Plate XXX; (I can discern but one pair of respiratory organs;) arrangement of hairs on segments as shown in the figure; claws of posterior pseudopods retractile.

Illinois localities: Illinois River at Grafton and La Grange, and the Sangamon River near its mouth.

Genus incertus C

Larva.—Length, 2–3 mm. Green. Head nearly twice as long as broad; eye spots large, confluent; antennæ very slender, half as long as head, second joint blackened (Pl. XXX, Fig. 8); labial plate elongate (Pl. XXIX, Fig. 22); thoracic and abdominal segments without hairs; anterior and posterior pseudopods elongate, the former with apical claws which are but little weaker than those of the posterior pair; dorsal blood-gills well developed; anal tufts weak, basal papillæ short and inconspicuous.

Illinois locality, Illinois River at Dresden Heights, by dredging.

Very probably this species belongs near *Cricotopus*, but no attempt was made to rear it.

Genus incertus D

Larva.—Length, 5–6 mm. Green. Head about a fourth longer than broad; antennæ about a third as long as head (Pl. XXX, Fig. 4), consisting of 6 joints; labium as in Figure 18, Plate XXIX, in one specimen with the central division and the one between the central tooth and the first lateral indistinct, as shown by upper outline in the

figure; mandibles with two moderately strong teeth and one weak tooth in addition to the apical one; anterior and posterior pseudopods stout and short, claws of posterior pair pale and inconspicuous; dorsal blood-gills stout and well developed; anal tufts each consisting of about 6 pale hairs, situated on weak papillæ; body without noticeable hairs.

Illinois locality, Illinois River at Grafton.

This species may belong to *Tanytarsus*. No attempt was made to rear the species, owing to press of other work.

Distribution of Chironomidæ in the Illinois River

The principal reason for undertaking the work upon *Chironomidæ*, the result of which is embodied in this paper, was to discover what species occurred in the Illinois River and connected lakes and to determine their distribution. Unfortunately we are not in possession of data or materials to warrant any definite statement as to the distribution of the species prior to the opening of the Chicago Drainage Canal; but it is reasonably safe to assume that before that time conditions on the upper Illinois were very similar to those on the lower portion of the river today. When, therefore, we discover that the *Chironomidæ* occur in markedly decreasing numbers as we near the outlet of the canal, where, under natural conditions, insect life should be as abundant as elsewhere on the river, it is an unavoidable conclusion that the comparative absence of these larvæ is an indication that the water is unsuited to their requirements. As previously stated under *Chironomus viridicollis*, the presence of "blood-worms" in any body of water is not an indication that such water is polluted, although they may be, and often are, found in water that is contaminated with sewage. There are, however, but few species to be found in badly polluted water, most species being confined to unpolluted water or to that which is but slightly tainted. Even blood-red larvæ are not in all cases found in polluted water, as the two largest species occurring in the Illinois are confined to the parts of the river which are comparatively clean.

C. ferrugineovittatus occurs principally in collections made in the various lakes (Fish, Crane, Stewart's, and Thompson's), but also in the channel of the river at Havana and Pekin. This is the largest species, measuring on an average slightly over two inches.

C. tentans (?), which averages an inch in length, is much more common than *ferrugineovittatus* and is more widely distributed, occurring indiscriminately in lakes and in the river channel north to

Peoria; but beyond that few specimens have been found, and none at all in that part of the river which is noticeably polluted.

C. lobiferus, a dull reddish species, averaging nearly half an inch in length, with only one pair of ventral blood-gills, is one of the commonest species represented in our collections, and occurs in almost every collection of any size from localities on the Illinois and connected waters up to and including De Pue and Hennepin, and also the semi-isolated De Pue Lake. It was not taken from the foul bottom anywhere above De Pue.

C. modestus, a green species found commonly in the lower river, at Havana, and also in other rivers and creeks throughout the state, was found in a single collection made at Ottawa.

C. viridicollis is one of the most widely distributed species represented in the river collections, occurring as far north as Spring Valley and Starved Rock, where the water is appreciably polluted.

Orthocladius sp. E occurred in collections from Spring Valley, Starved Rock, and Marseilles.

In the part of the river beyond Ottawa (eastward) but few larvæ were found, but examples of *Tanypus dyari* occur among the collections made at Marseilles, above the dam, and at Morris. This species has been reared from larvæ found in Boneyard Creek at Urbana, which is badly polluted with sewage; and it is reported to have been reared from larvæ found in temporary puddles on waste ground at Washington, D. C.

A species, greenish in color and measuring about 7 mm., which I am unable to identify exactly—it may be *C. flavus*—has been found in a great number of collections from different parts of the river. The fact that Ottawa is among the localities from which it is listed in my notes, shows that it occurs in the polluted portion of the river as well as in parts that are comparatively clean—as at Havana.

Although we have no data connected with the upper part of the river prior to the opening of the canal which can be compared with data obtained since that event, we have evidence that in other Illinois rivers, where there are no such conditions of pollution, the insect fauna does not suffer material diminution towards the sources of these rivers, though at times there may be a change in its constituents.

From the fact that out of probably one hundred species of *Chironomidæ* that may be found in various portions of the lower Illinois not over a dozen are met with in the portion between De Pue and Morris, it is, to my mind, clearly evident that the influx of sewage matter from the drainage canal in question very seriously reduces the number of these insects normal to the river.

Summary of Illinois Genera and Species in Comparison with those recorded for other States

The following list gives a numerical summary of the genera and species of *Chironomidæ* that have been taken in Illinois. As the list is very largely the result of collecting by Mr. Hart and the writer during 1914, practically all the included species having been taken on occasional collecting trips during that year, and as much of the area within the state has not been visited, the number of species here listed is in no respect complete, even for the localities to which periodical visits were made.

Number of Illinois Species recorded

Chironomidæ (27 genera, 178 species)	Ceratopogoninæ		Tanypinæ		Chironominæ	
	Genera	No. of spp.	Genera	No. of spp.	Genera	No. of spp.
	Culicoides	7	Tanypus	12	Diamesa	1
	Ceratopogon	4	Protenthes	5	Thalassomyia	2
	Pseudoculicoides	2	Procladius	3	Corynoneura	2
	Forcipomyia	6	Cœlotanypus	1	Chironomus	56
	Palpomyia	6			Tanytarsus	11
	Heteromyia	5			Metriocnemus	2
	Serromyia	1			Chasmatonotus	1
	Johannsenomyia	7			Pseudochironomus	1
	Hartomyia	3			Cricotopus	5
	Bezzia	5			Camptocladius	7
	Probezzia	7			Orthocladius, sens. lat.	15
	Parabezzia	1				
Totals	12	54	4	21	11	103

The above list, comprising, as it does, 27 genera and 178 species, is the largest state list yet published for the family. Smith's "Insects of New Jersey," 1909, gives 82 species distributed over 22 genera, according to the arrangement of the present paper, as in the following table.

NUMBER OF NEW JERSEY SPECIES RECORDED

	Ceratopogoninæ		Tanypinæ		Chironominæ	
Chironominæ (22 genera, 82 species)	Genera	No. of spp.	Genera	No. of spp.	Genera	No. of spp.
	Culicoides	2	Tanypus	9	Thalassomyia	1
	Ceratopogon?	4	Protenthes	1	Chironomus	26
	Forcipomyia	1	Psilotanypus	1	Metriocnemus	1
	Palpomyia	5	Procladius	2	Eurycnemus	1
	Heteromyia	5			Chasmatonotus	1
	Johannsenomyia	3			Cricotopus	3
	Hartomyia	3			Camptocladius	2
	Bezzia	4			Orthocladius, sens. lat.	3
	Pseudobezzia	1				
	Probezzia	3				
Totals	10	31	4	13	8	38

Prof. O. A. Johannsen in his two papers frequently referred to in the present article (1905 and 1908) has given extensive lists of *Tanypinæ* and *Chironominæ* for New York State, but has made no attempt to deal with *Ceratopogoninæ* in the same manner. I have in the present paper listed a number of species of *Ceratopogoninæ* submitted by Professor Johannsen from New York, but these represent but a small portion of the species that must occur there.

The following table gives numerical lists of *Tanypinæ* and *Chironominæ* compiled from Johannsen's papers.

NUMBER OF SPECIES RECORDED BY JOHANNSEN

	Tanypinæ		Chironominæ	
Chironomidæ (13 genera, 94 species)	Genera	No. of spp.	Genera	No. of spp.
	Tanypus	10	Diamesa	1
	Protenthes	3	Thalassomyia	1
	Procladius	4	Corynoneura	1
			Chironomus	40
			Tanytarsus	13
			Metriocnemus	5
			Chasmatonotus	1
			Cricotopus	4
			Camptocladius	3
			Orthocladius, sens. lat.	8
Totals	3	17	10	77

The above table gives a total of 94 species and 13 genera. The same subfamilies are represented in the Illinois list by 124 species and 15 genera, and in the New Jersey list by 51 species and 12 genera.

In none of the three states can the list be considered as exhaustive, and much work remains to be done before analytical comparison can be made between the genera and species of these or other states.

Of the 54 species of *Ceratopogoninæ* listed as occurring in Illinois, 21 are described as new either in the present paper or in recent articles by the writer. Six of these species have been taken in other states; 3 in Michigan—one of these occurring also in Arizona—1 in New York, 1 in Indiana, and 1 in Virginia. Of the 21 species of *Tanypinæ* listed as occurring in the state, 5 are described as new. None of the new species have been seen from other states up to the present time. Of the 103 species of *Chironominæ* listed for Illinois 50 are described as new, 6 of these being also represented in the Laboratory collection by specimens from other states.

One of the most striking instances of the unexpected occurrence of a species is that of *Chironomus octopunctatus* Loew. This species was originally described from Cuba, in the West Indies, and has not hitherto been recorded again as far as I am aware. Two specimens were taken on store windows in Urbana in October.

The fragmentary condition of our knowledge of the species of *Chironomidæ* occurring in North America furnishes insufficient data for an indication of even their probable distribution. I have included under the species descriptions in this paper, lists of states for which I have found records of the occurrence of the species, but no doubt the lists are incomplete in some cases. It is also probable that in some instances erroneous indentifications are listed, but without having access to the material upon which these records are based the writer can not indicate misidentifications.

Urbana, Illinois, May 1, 1915.

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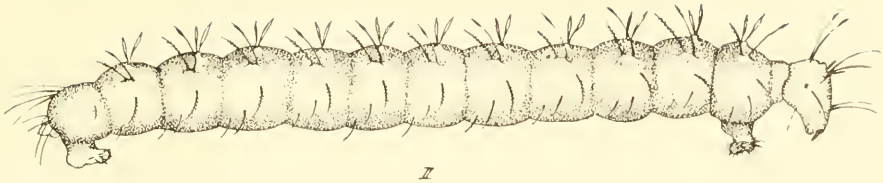
Plate XVII

Larvæ and Pupa of Ceratopogoninæ

Fig. 1. *Forcipomyia specularis,* larva, lateral view.
Fig. 2. The same, dorsal view.
Fig. 3. *Forcipomyia cilipes,* larva, lateral view.
Fig. 4. *Ceratopogon fusculus,* larva, dorsal view.
Fig. 5. *Palpomyia?* sp.?, pupa, dorsal view.
Fig. 6. *Palpomyia longipennis,* larva, lateral view.

PLATE XVII



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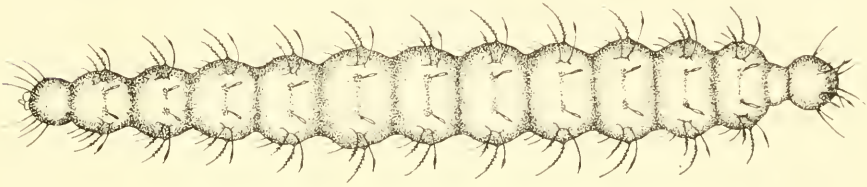

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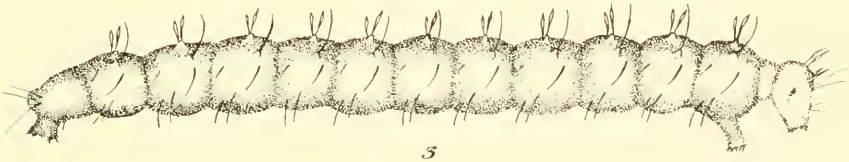

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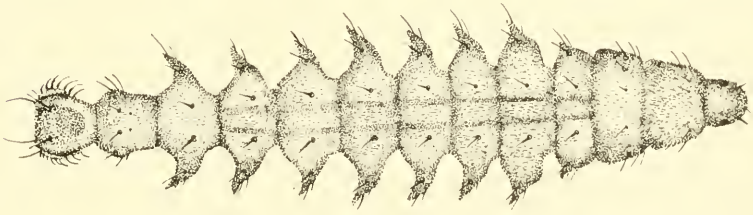

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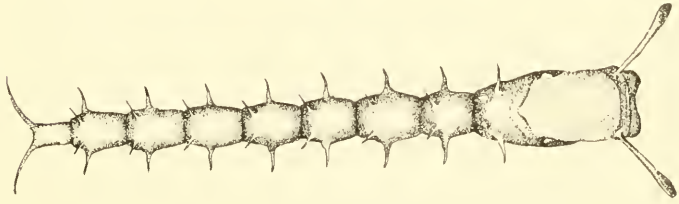

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Plate XVIII

Larval and Pupal Details of Ceratopogonina

Fig. 1. *Ceratopogon fusculus*, dorsal abdominal bristle of pupa.
Fig. 2. *Forcipomyia cilipes*, section of thoracic respiratory organ of pupa.
Fig. 3. The same, lateral abdominal bristle of pupa.
Fig. 4. The same, dorsal bristle of larva.
Fig. 5. The same, dorso-lateral bristle of larva.
Fig. 6. The same, anterior thoracic bristle of pupa.
Fig. 7. *Ceratopogon fusculus*, lateral view of second abdominal segment of pupa.
Fig. 8. *Forcipomyia pergandei?*, lateral view of second abdominal segment of pupa.
Fig. 9. *Forcipomyia cilipes*, claws of anterior pseudopods.
Fig. 10. The same, claws of posterior pseudopods.
Fig. 11. *Forcipomyia specularis*, dorsal surface of abdominal segment of larva.
Fig. 12. *Palpomyia longipennis*, mandible of larva.
Fig. 13. The same, labium of larva.
Fig. 14. *Forcipomyia specularis*, mandible of larva.
Fig. 15. *Forcipomyia pergandei?*, antenna of larva.
Fig. 16. *Palpomyia longipennis*, hypopharynx of larva.
Fig. 17. *Forcipomyia specularis*, dorsal bristle of larva, front view.
Fig. 18. The same, dorsal bristle of larva, side view.
Fig. 19. *Ceratopogon fusculus*, arrangement of bristles on thorax of pupa.
Fig. 20. *Forcipomyia specularis*, arrangement of bristles on thorax of pupa.
Fig. 21. *Forcipomyia pergandei?*, anterior thoracic bristle of pupa.

PLATE XVIII

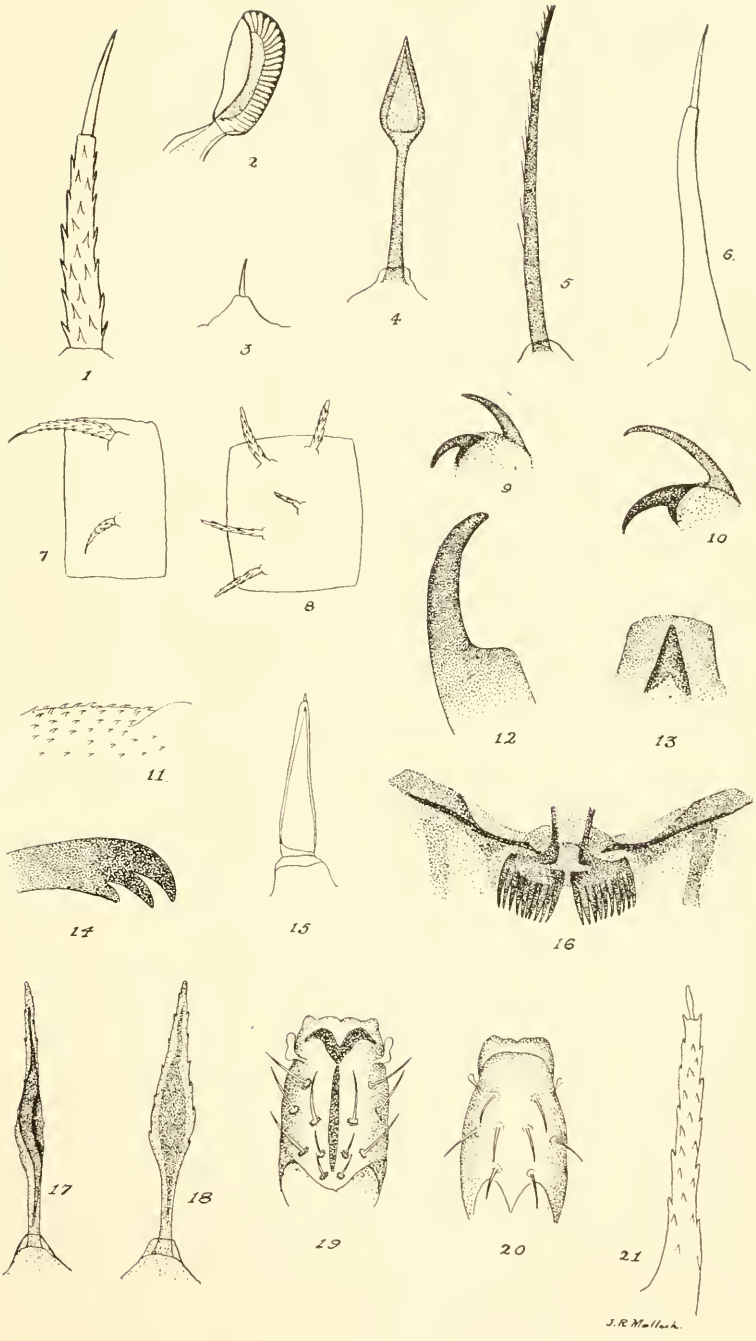
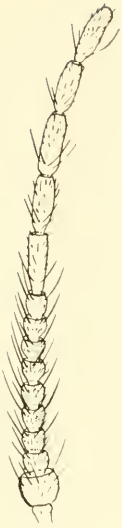


Plate XIX

Structural Details of Ceratopogonina

Fig. 1. *Ceratopogon fusculus*, antenna of female.
Fig. 2. *Forcipomyia specularis*, hypopygium, dorsal view.
Fig. 3. *Forcipomyia ciliipes*, palpus of male.
Fig. 4. The same, apex of abdomen of female, lateral view.
Fig. 5. The same, fourth antennal joint of female.
Fig. 6. *Ceratopogon fusculus*, last four antennal joints of male.
Fig. 7. *Palpomyia flavidulus*, hypopygium, dorsal view.
Fig. 8. *Ceratopogon fusculus*, palpus of male.

PLATE XIX



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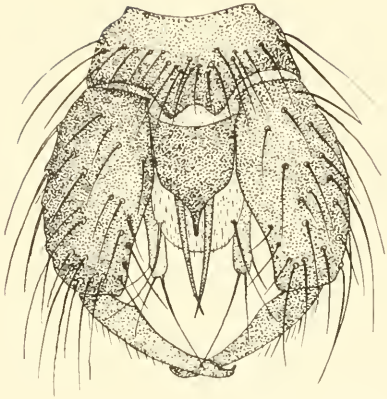

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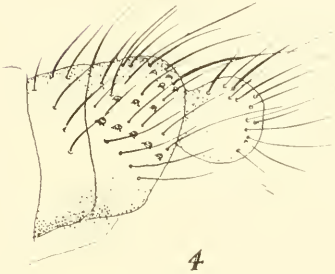

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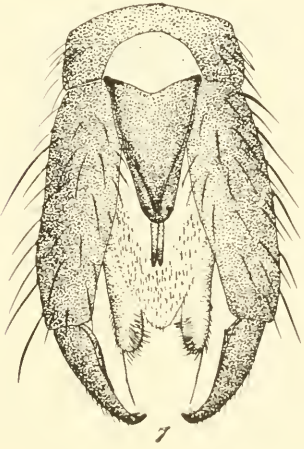

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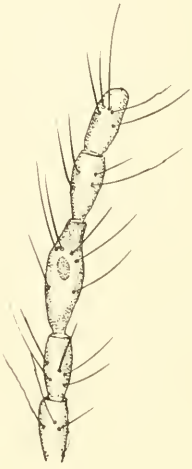

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Plate XX

Structural Details of Ceratopogoninæ

Fig. 1. *Pseudoculicoides mutabilis*, hypopygium, one side.
Fig. 2. The same, apical five antennal joints of male.
Fig. 3. *Culicoides hæmatopotus*, lateral arm of hypopygium.
Fig. 4. *Culicoides sanguisugus*, apical four antennal joints of male.
Fig. 5. *Culicoides hæmatopotus*, apical four antennal joints of male.
Fig. 6. *Culicoides varipennis*, hypopygium, one side.
Fig. 7. *Culicoides crepuscularis*, apical four antennal joints of male.
Fig. 8. *Culicoides varipennis*, apical four antennal joints of male.
Fig. 9. *Culicoides sanguisugus*, third joint of flagellum of antenna of female.
Fig. 10. The same, palpus of female.
Fig. 11. *Culicoides varipennis*, pupa, lateral view.
Fig. 12. The same, dorsal view of one half of third abdominal segment of pupa.
Fig. 13. The same, dorsal view of apex of pupa.
Fig. 14. The same, third joint of flagellum of antenna of female.
Fig. 15. The same, tarsal claw of male.
Fig. 16. *Culicoides crepuscularis*, hypopygium, one side.
Fig. 17. *Culicoides varipennis*, thoracic respiratory organ of pupa.
Fig. 18. *Culicoides sanguisugus*, hypopygium, one side.

Plate XX

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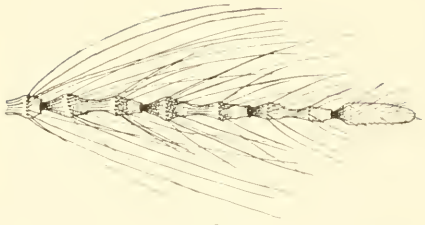

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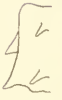

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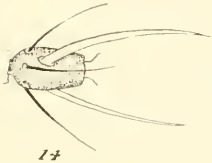

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Plate XXI

Structural Details of Ceratopogonina

Fig. 1. *Forcipomyia cilipes*, hypopygium, one side.
Fig. 2. *Forcipomyia aurea*, hypopygium, one side.
Fig. 3. *Forcipomyia squamipes*, hypopygium, one side.
Fig. 4. *Forcipomyia cilipes*, hind tibia of female.
Fig. 5. *Forcipomyia pergandei*, apical four antennal joints of male (denuded).
Fig. 6. *Forcipomyia cilipes*, apical four antennal joints of male (denuded).
Fig. 7. *Forcipomyia aurea*, apical four antennal joints of male (denuded).
Fig. 8. *Forcipomyia specularis*, apical four antennal joints of male (denuded).
Fig. 9. *Pseudoculicoides major*, hypopygium, one side.
Fig. 10. *Pseudoculicoides johannseni*, hypopygium, one side.
Fig. 11. *Forcipomyia cilipes*, three basal flagellar joints of male (denuded).
Fig. 12. *Forcipomyia specularis*, second and third flagellar joints of same.
Fig. 13. *Forcipomyia specularis*, same joints of female.
Fig. 14. *Ceratopogon levis*, second flagellar joint of male.
Fig. 15. *Ceratopogon levis*, apical flagellar joint of male.
Fig. 16. *Palpomyia illinoensis*, respiratory organ of pupa.
Fig. 17. *Pseudoculicoides cinctus*, hypopygium, one side.
Fig. 18. *Ceratopogon fusculus*, hypopygium, one side.
Fig. 19. *Ceratopogon levis*, hypopygium, one side.
Fig. 20. *Ceratopogon fusinervis*, hypopygium, one side.

PLATE XXI

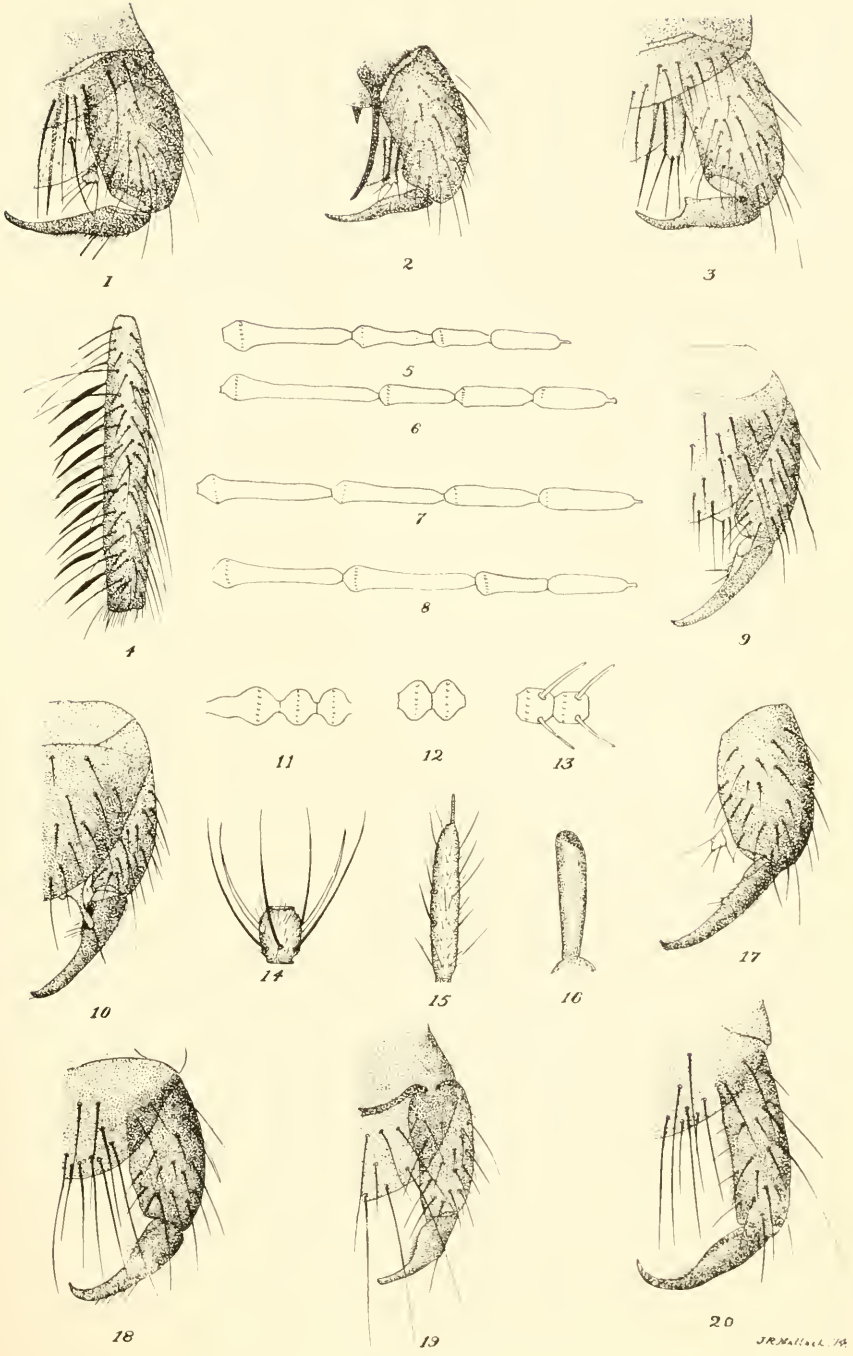
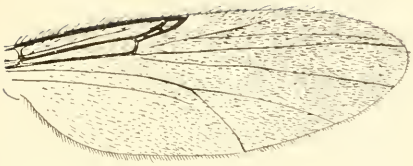


Plate XXII

Wings of Ceratopogonina

Fig. 1. *Forcipomyia specularis*, male.
Fig. 2. *Culicoides varipennis*, female.
Fig. 3. *Culicoides sanguisugus*, female.
Fig. 4. *Culicoides guttipennis*, female.
Fig. 5. *Culicoides stellifer*, male.
Fig. 6. *Culicoides hæmatopotus*, female.
Fig. 7. *Culicoides crepuscularis*, female.
Fig. 8. *Ceratopogon fusculus*, female.
Fig. 9. *Probezzia glaber*, female.
Fig. 10. *Palpomyia schwarzi*, female.
Fig. 11. *Hartomyia picta*, male.
Fig. 12. *Johannsenomyia bimaculata*, female.

PLATE XXII



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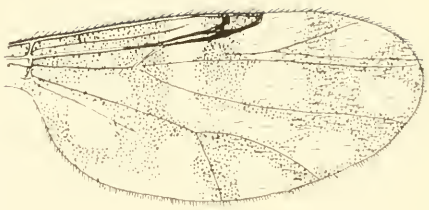

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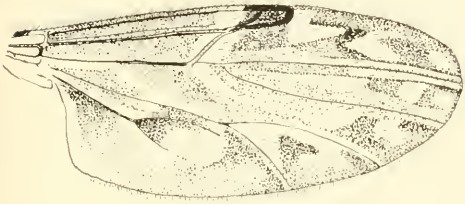

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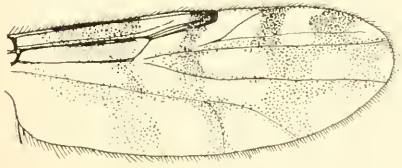

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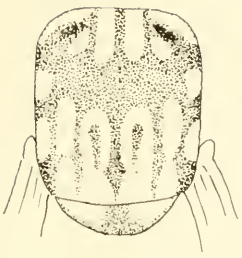
Plate XXIII

Structural Details of Chironomidæ and Dixidæ

Fig. 1. *Culicoides guttipennis*, thoracic dorsum.
Fig. 2. *Culicoides crepuscularis*, thoracic dorsum.
Fig. 3. *Culicoides hieroglyphicus*, thoracic dorsum.
Fig. 4. *Procladius thoracicus*, head and anterior portion of thorax, lateral view: *P.*, pronotum; *M.*, mesonotum; *Sp.*, anterior spiracle; *Cox.*, anterior coxa.
Fig. 5. *Johannseniomyia argentata*, head and anterior portion of thorax, lateral view: *P.*, pronotum; *M.*, mesonotum; *Sp.*, anterior spiracle; *Cox.*, anterior coxa.
Fig. 6. *Ceratopogon fusinervis*, head and anterior portion of thorax, lateral view: *P.*, pronotum; *M.*, mesonotum; *Sp.*, anterior spiracle; *Cox.*, anterior coxa.
Fig. 7. *Chironomus* sp. B., ventral surface of labrum.
Fig. 8. *Chironomus digitatus*, lateral arm of labrum.
Fig. 9. *Dixa* sp., labium.
Fig. 10. *Chironomus tentans?*, labial papillæ.
Fig. 11. *Diamesa waltlii*, hypopygium.
Fig. 12. *Dixa* sp., head, dorsal view: *A*, antenna; *B*, clypeus; *C*, labrum; *D*, maxillary palpi; *E*, mandible; *F*, maxillary lobe (?).

PLATE XXIII



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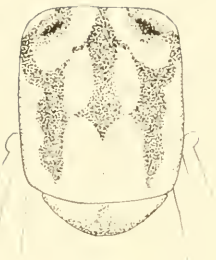

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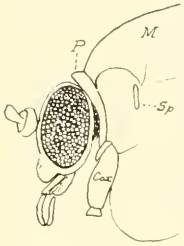

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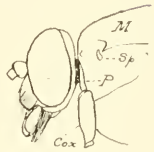

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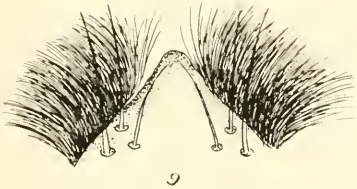

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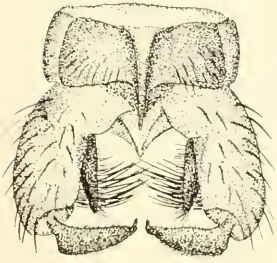

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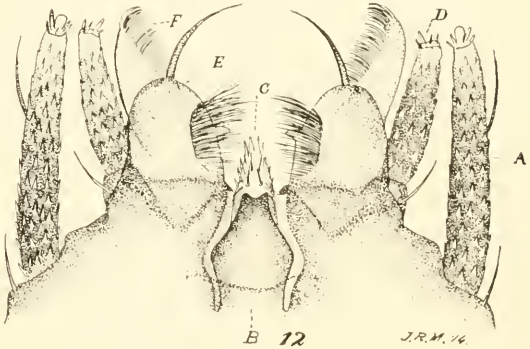

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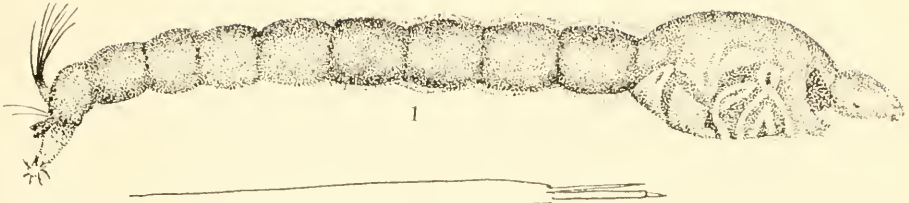
J.R.M. 14.

Plate XXIV

Larval and Pupal Details of Tanypina

Fig. 1. *Tanypus monilis*, larva, just before pupation.
Fig. 2. The same, antenna of larva.
Fig. 3. *Protenthes culiciformis*, antenna of larva.
Fig. 4. The same, maxillary palpus of larva.
Fig. 5. *Protenthes stellatus*, apical abdominal appendage of pupa.
Fig. 6. *Procladius concinnus*, maxillary palpus of larva.
Fig. 7. *Tanypus illinoensis*, pupa.
Fig. 8. *Tanypus* sp. B, antenna of larva.
Fig. 9. The same, maxillary palpus of larva.
Fig. 10. *Tanypus monilis*, maxillary palpus of larva.
Fig. 11. *Protenthes culiciformis*, thoracic respiratory organ of pupa.
Fig. 12. *Tanypus* sp. A, maxillary palpus of larva.
Fig. 13. The same, antenna of larva.
Fig. 14. *Tanypus pilosellus?*, thoracic respiratory organ of pupa.
Fig. 15. *Procladius concinnus*, antenna of larva.
Fig. 16. *Tanypus dyari*, thoracic respiratory organ of pupa.
Fig. 17. *Tanypus* sp. A, mandible of larva.
Fig. 18. *Tanypus dyari*, mandible of larva.
Fig. 19. *Tanypus monilis*, thoracic respiratory organ of pupa.

PLATE XXIV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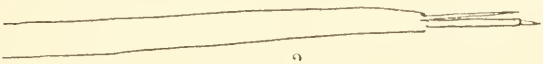
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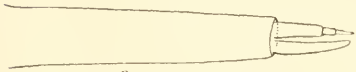
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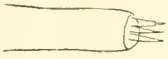
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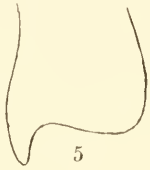
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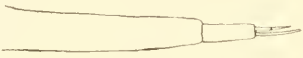
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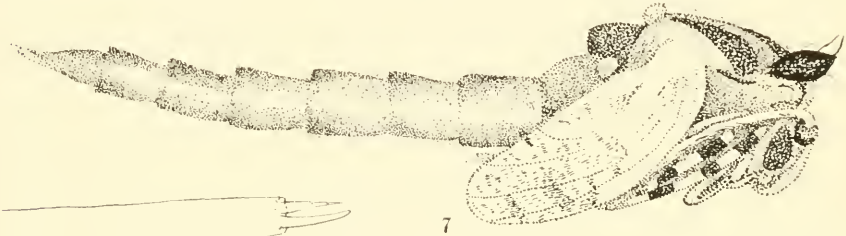
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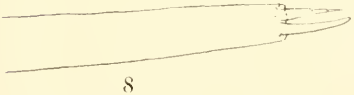
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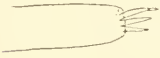
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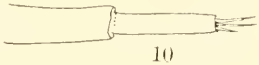
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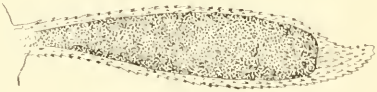
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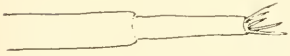
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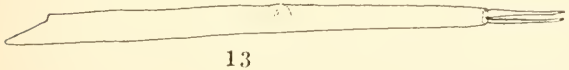
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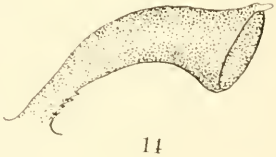
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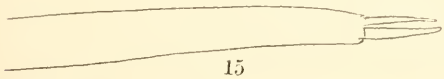
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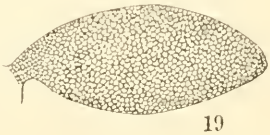
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Plate XXV

Larval Details of Tanypinæ

Fig. 1. *Tanypus dyari*, labial plate of larva.
Fig. 2. *Tanypus* sp. A, labial plate of larva.
Fig. 3. *Protenthes carneus*, labial plate of larva.
Fig. 4. *Tanypus* sp. A, labial papillæ of larva.
Fig. 5. *Tanypus* sp. B, labial plate of larva.
Fig. 6. *Procladius concinnus*, labial plate of larva.
Fig. 7. *Tanypus monilis*, labial plate of larva.
Fig. 8. *Protenthes culiciformis*, labial plate of larva.
Fig. 9. *Procladius concinnus*, labial papillæ of larva.
Fig. 10. *Tanypus decoloratus*, labial plate of larva.
Fig. 11. *Tanypus pilosellus?*, labial plate of larva.
Fig. 12. *Procladius concinnus*, labrum of larva.

PLATE XXV

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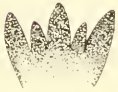

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Plate XXVI

Larval and Pupal Details of Tanypinæ

Fig. 1. *Tanypus decoloratus*, mandible of larva.
Fig. 2. *Tanypus dyari*, mandible of larva.
Fig. 3. *Tanypus dyari*, hypopharynx of larva.
Fig. 4. *Protenthes punctipennis*, apical abdominal appendage of pupa.
Fig. 5. *Tanypus dyari*, claw of posterior pseudopod of larva.
Fig. 6. *Procladius concinnus*, lateral abdominal hair of larva.
Fig. 7. *Protenthes culiciformis*, under side of head of larva, showing location of different organs.
Fig. 8. *Tanypus piloscllus?*, apical abdominal appendage of pupa.
Fig. 9 and 10. *Protenthes bellus*, claws of posterior pseudopods of larva.
Fig. 11. *Tanypus dyari*, antenna of larva.
Fig. 12. *Protenthes bellus*, apical abdominal appendage of pupa.
Fig. 13. *Protenthes punctipennis*, thoracic respiratory organ of pupa.
Fig. 14. *Tanypus piloscllus?*, under side of larval head.
Fig. 15. *Procladius concinnus*, apex of abdomen of larva, dorsal view.

Plate XXVI

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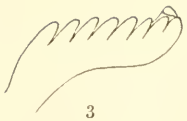

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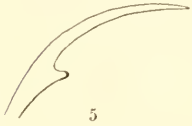

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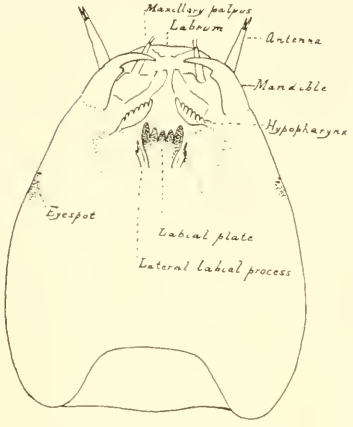

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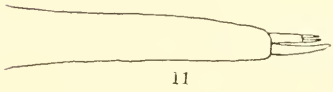

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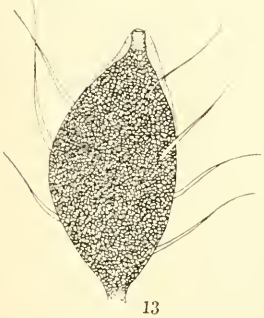

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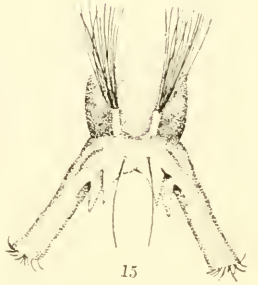

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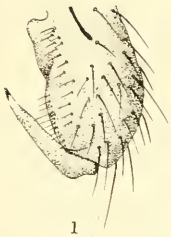
Plate XXVII

Structural Details of Tanypinæ

Fig. 1. *Protenthes stellatus*, hypopygium, one side.
Fig. 2. *Protenthes punctipennis*, wing.
Fig. 3. *Protenthes punctipennis*, hypopygium, one side.
Fig. 4. *Procladius concinnus*, thoracic respiratory organ of pupa.
Fig. 5. *Protenthes stellatus*, wing.
Fig. 6. *Tanypus decoloratus*, thoracic respiratory organ of pupa.
Fig. 7. *Protenthes claripennis*, apical portion of lateral arm of hypopygium.
Fig. 8. *Protenthes choreus*, wing.
Fig. 9. *Protenthes bellus*, thoracic respiratory organ of pupa.
Fig. 10. *Tanypus marginellus*, hypopygium, one side.
Fig. 11. *Tanypus monilis*, wing.
Fig. 12. *Tanypus dyari*, hypopygium, one side.

Plate XXVII



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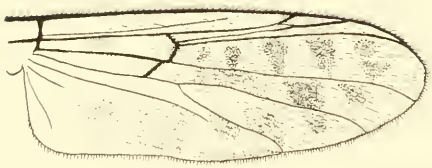

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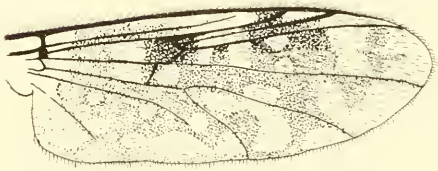

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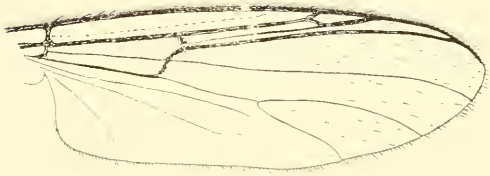

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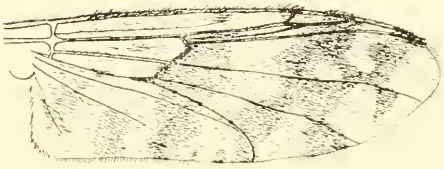

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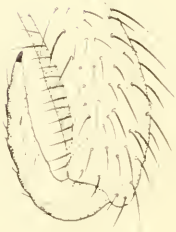

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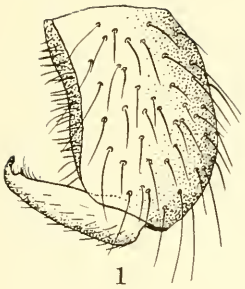
Plate XXVIII

Hypopygia of Tanypinæ

Fig. 1. *Tanypus decoloratus.*
Fig. 2. *Tanypus hirtipennis.*
Fig. 3. *Tanypus melanops.*
Fig. 4. *Protenthes choreus.*
Fig. 5. *Protenthes culiciformis.*
Fig. 6. *Procladius concinnus.*
Fig. 7. *Protenthes riparius.*
Fig. 8. *Procladius scapularis.*
Fig. 9. *Procladius thoracicus.*
Fig. 10. *Tanypus illinoensis.*
Fig. 11. *Tanypus monilis.*
Fig. 12. *Protenthes bellus.*

PLATE XXVIII



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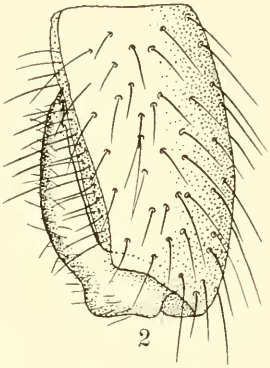

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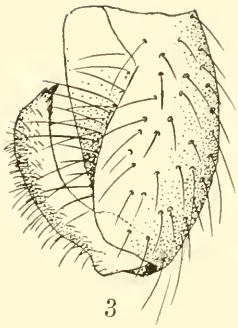

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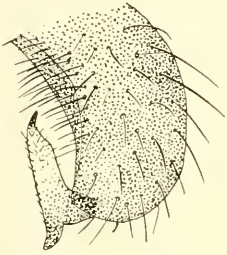

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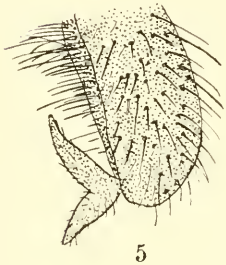

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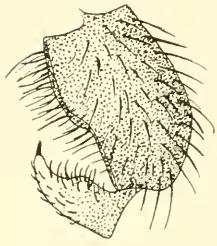

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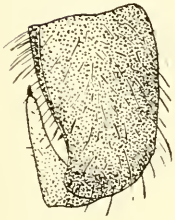

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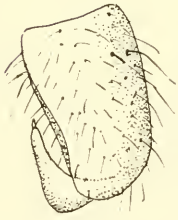

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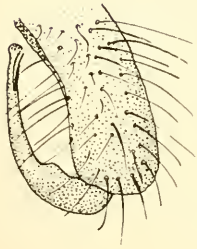

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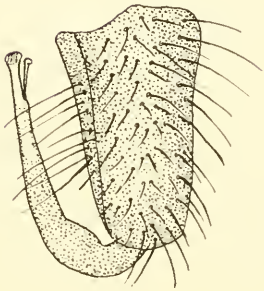

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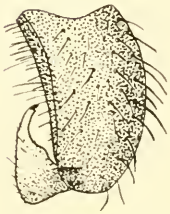

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Plate XXIX

Larval Labia of Chironominæ

Fig. 1. *Chironomus flavicingula.*
Fig. 2. *Chironomus viridis.*
Fig. 3. *Diamesa waltlii.*
Fig. 4. *Chironomus flavus.*
Fig. 5. *Chironomus* sp. B.
Fig. 6. *Chironomus fulviventris.*
Fig. 7. *Chironomus lobiferus.*
Fig. 8. *Chironomus lobiferus*, var.?
Fig. 9. *Chironomus tentans?*
Fig. 10. *Chironomus viridicollis.*
Fig. 11. *Chironomus viridicollis*, aberration.
Fig. 12. *Cricotopus trifasciatus.*
Fig. 13. *Orthocladius* sp. A.
Fig. 14. *Tanytarsus* sp. C.
Fig. 15. *Genus incertus* A.
Fig. 16. *Orthocladius nivoriundus.*
Fig. 17. *Orthocladius* sp. E.
Fig. 18. *Genus incertus* D.
Fig. 19. *Tanytarsus exiguus.*
Fig. 20. *Orthocladius* sp. C.
Fig. 21. *Orthocladius* sp. B.
Fig. 22. *Genus incertus* C.
Fig. 23. *Genus incertus* B.

Plate XXIX

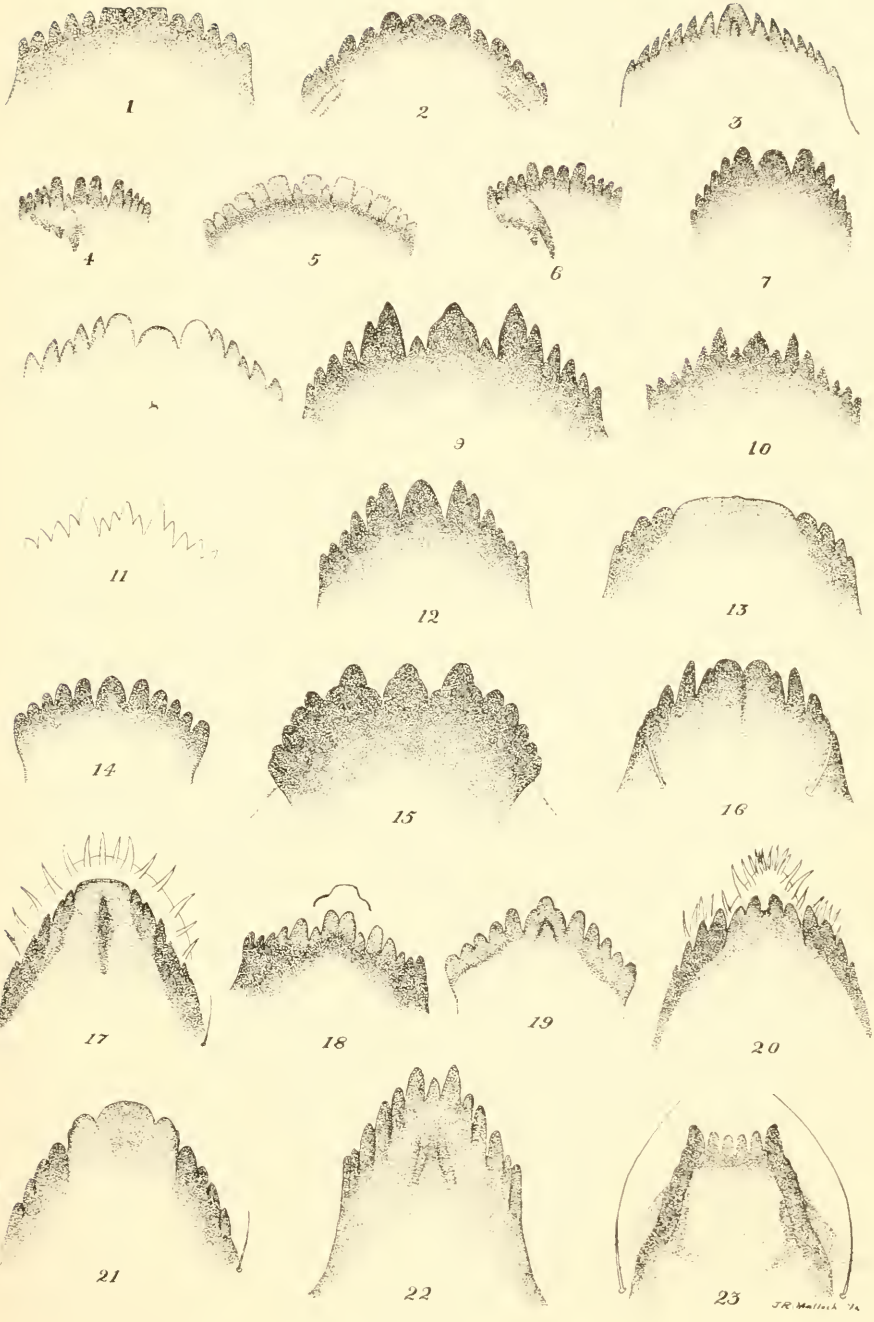


Plate XXX

Larval Details of Chironominæ

Fig. 1. *Genus incertus* A, mandible.
Fig. 2. *Chironomus* sp. B, antenna.
Fig. 3. *Chironomus* sp. B, mandible.
Fig. 4. *Genus incertus* D, antenna.
Fig. 5. *Chironomus* sp. B, maxillary palpus.
Fig. 6. *Chironomus* sp. B, antenna.
Fig. 7. *Genus incertus* B, anal segments.
Fig. 8. *Genus incertus* C, antenna.
Fig. 9. *Cricotopus trifasciatus*, antenna.
Fig. 10. *Chironomus flavicingula*, antenna.
Fig. 11. *Genus incertus* B, antenna.
Fig. 12. *Chironomus digitatus*, mandible.
Fig. 13. *Chironomus digitatus*, labium.
Fig. 14. *Chironomus palliatus*, mandible.

Plate XXX

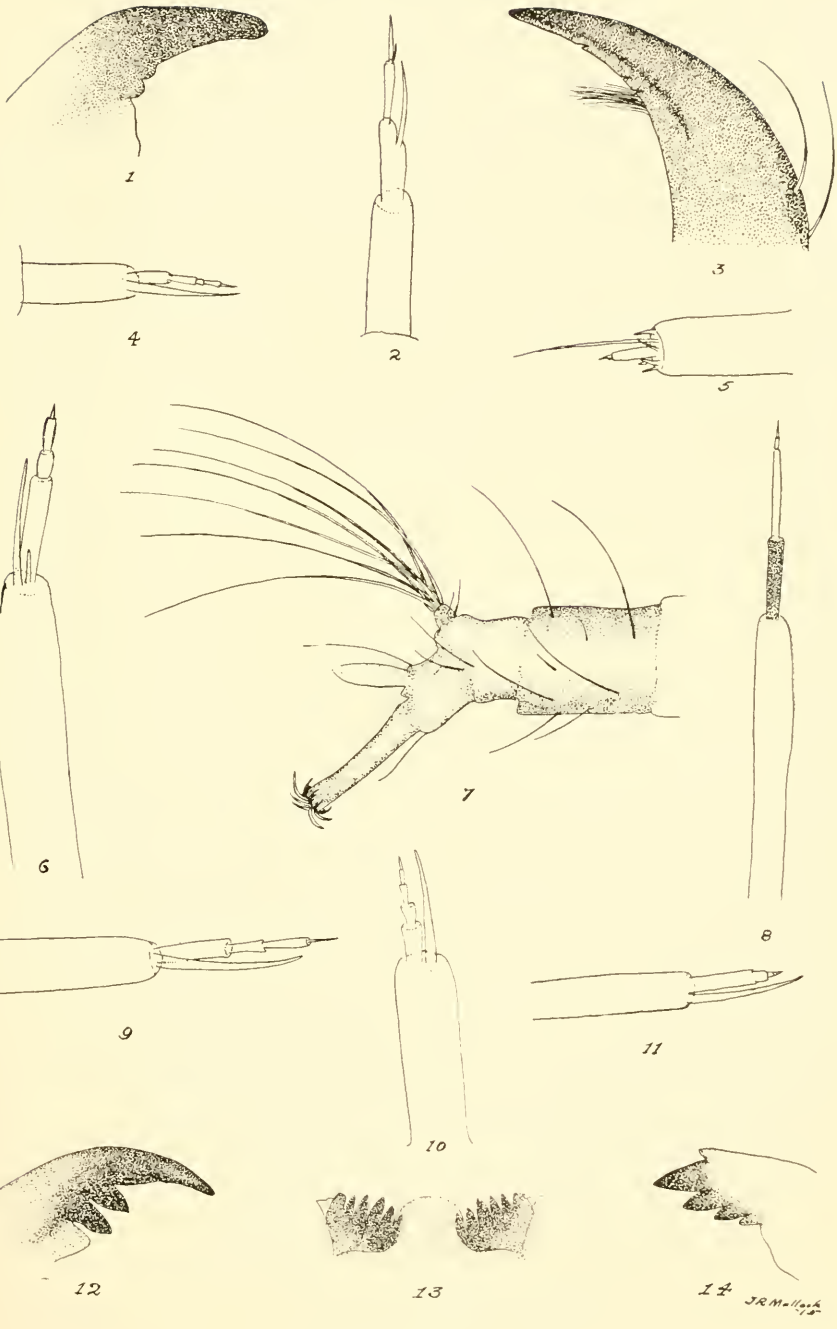


Plate XXXI

Details of Chironomus Pupæ

Fig. 1. Frontal tubercle of *flavicingula*.
Fig. 2. Dorsal abdominal lobe of *lobiferus*.
Fig. 3. Apical lateral process of segment 8 of *decorus*.
Fig. 4. Second dorsal abdominal segment of *flavicingula*.
Fig. 5. Ventral surface of apical segment of *digitatus* (female).
Fig. 6. Apical lateral process of segment 8 of *viridis*.
Fig. 7. Second dorsal abdominal segment of *viridis*.
Fig. 8. Dorsal abdominal setulæ of *viridis*: *a*, *b*, and *c*, setulæ of transverse group; *d*, setula of central group.
Fig. 9. Second dorsal abdominal segment of *digitatus*.
Fig. 10. Third dorsal abdominal segment of *modestus*.
Fig. 11, *a* and *b*. Apical lateral process of *Chironomus* sp. A, showing variation in form in different individuals.
Fig. 12. Frontal tubercle of *decorus*.
Fig. 13. Third dorsal abdominal segment of *indistinctus*.
Fig. 14. Apical lateral process of segment 8 of *indistinctus*.
Fig. 15, *a*, reticulation of abdominal segments; *b*, *c*, *d*, dorsal abdominal setulæ of *digitatus*.
Fig. 16. Apical lateral process of segment 8 of *palliatus*.
Fig. 17. Apical lateral process of segment 8 of *modestus*.
Fig. 18. Apical lateral process of segment 8 of *flavicingula*.

Plate XXXI

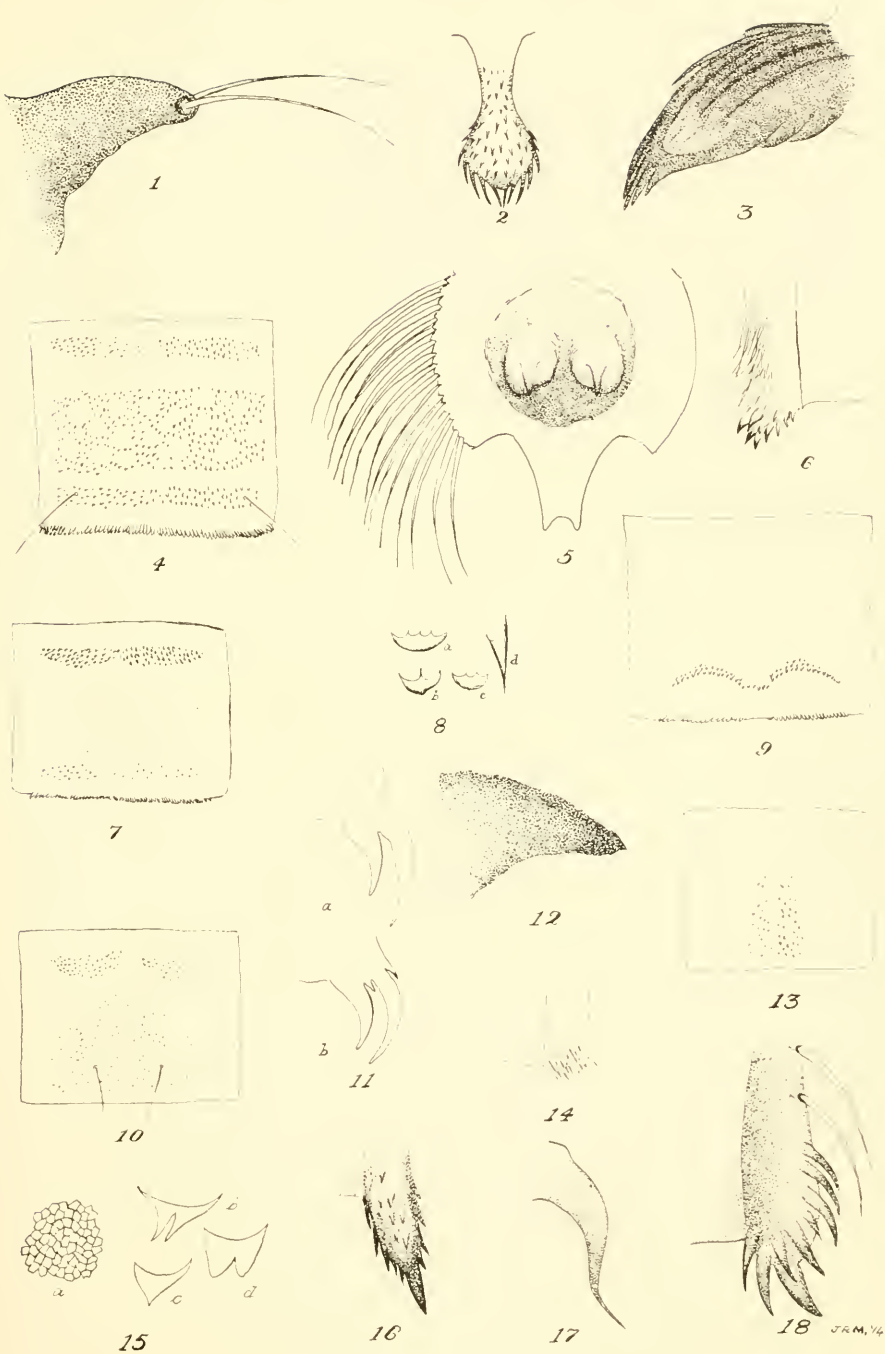


Plate XXXII

Structural Details of Chironomina and Larval Case of Tanytarsus

Fig. 1. *Chironomus crassicaudatus*, palpus of male.
Fig. 2. *Chironomus tentans* ?, larva.
Fig. 3. *Chironomus quadripunctatus*, palpus of male.
Fig. 4. *Chironomus plumosus*, labium of larva (after Johannsen).
Fig. 5. *Tanytarsus* sp.?, larval case.
Fig. 6. *Chironomus palliatus*, labium of larva.
Fig. 7. *Cricotopus trifasciatus*, pupa.
Fig. 8. *Chironomus nigricans*, palpus of male.
Fig. 9. *Trichocladius politus*, tarsal claw of male.
Fig. 10. *Chironomus ferrugincovittatus*, male.
Fig. 11. *Chironomus taeniapennis*, palpus of male.
Fig. 12. *Chironomus palliatus*, antenna of hermaphrodite.
Fig. 13. *Camptocladius lasiops*, antenna of female.

PLATE XXXII

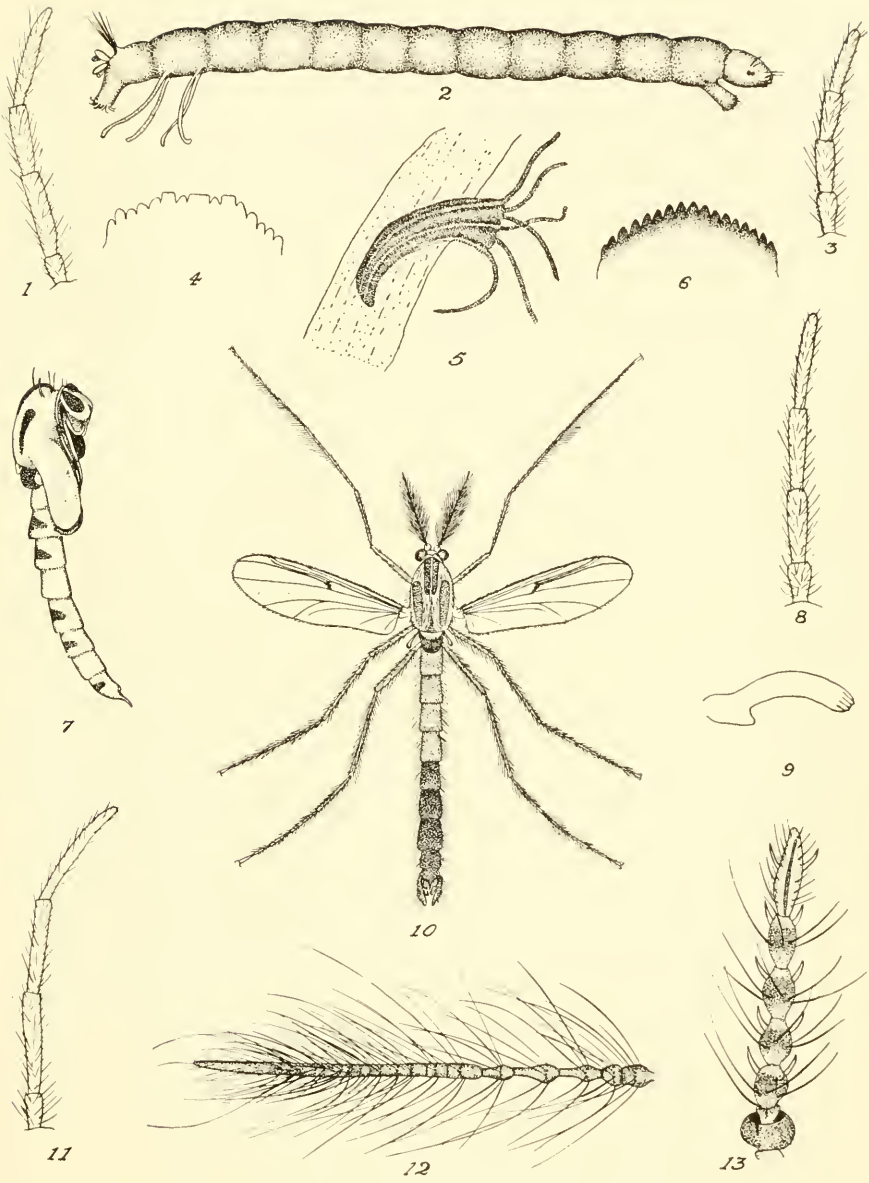


Plate XXXIII

Hypopygia of Chironomus spp.

Fig. 1. *C. tentans.*
Fig. 2. *C. pseudoviridis*, one side.
Fig. 3. *C. viridis*, one side.
Fig. 4. *C. ferrugineovittatus.*
Fig. 5. *C. flavicingula.*
Fig. 6. *C. frequens*, one side.
Fig. 7. *C. fallax*, one side.
Fig. 8. *C. brachialis.*
Fig. 9. *C. lobiferus.*
Fig. 10. *C. nigrohalteralis*, one side.
Fig. 11. *C. decorus.*
Fig. 12. *C. tenuicaudatus.*
Fig. 13. *C. crassicaudatus.*
Fig. 14. *C. festivus*, one side.
Fig. 15. *C. subaequalis*, one side.
Fig. 16. *C. palliatus.*

Plate XXXIII

Plate XXXIV

Hypopygia of Chironomus spp.

Fig. 1. *C. illinoensis*, one side.
Fig. 2. *C. nigrovittatus*, one side.
Fig. 3. *C. nigricans*, inferior process.
Fig. 4. *C. pallidus*, one side.
Fig. 5. *C. obscuratus*, one side.
Fig. 6. *C. indistinctus*, superior process.
Fig. 7. *C. indistinctus*, inferior process.
Fig. 8. *C. modestus*, one side, *a*, inferior process.
Fig. 9. *C. abortivus*, one side.
Fig. 10. *C. fuscicornis*, one side.
Fig. 11. *C. dimorphus*, one side.
Fig. 12. *C. dimorphus*, superior process.
Fig. 13. *C. crassicaudatus*, lateral view.
Fig. 14. *C. flavus*, one side.
Fig. 15. *C. halteralis*, one side.
Fig. 16. *C. fulvus*, one side.
Fig. 17. *C. plumosus*, apical portion of lateral arm.
Fig. 18. *C. abbreviatus*, one side and superior process.

PLATE XXXIV

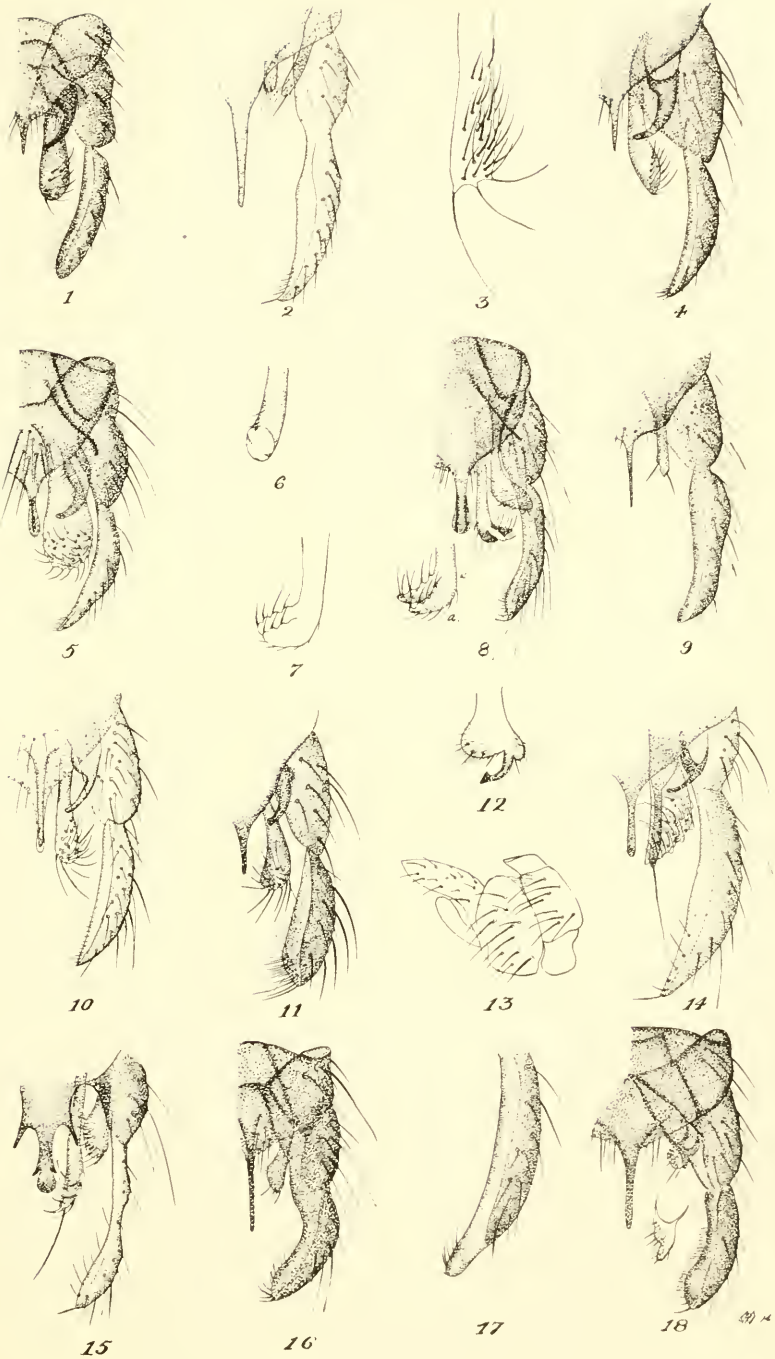
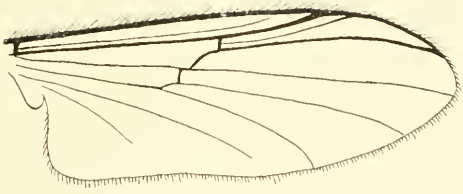


Plate XXXV

Wings of Chironomina

Fig. 1. *Diamesa waltlii.*
Fig. 2. *Chironomus brachialis.*
Fig. 3. *C. needhami.*
Fig. 4. *C. perpulcher.*
Fig. 5. *C. pulchripennis.*
Fig. 6. *C. taeniapennis.*
Fig. 7. *C. varipennis.*
Fig. 8. *Chasmatonotus bimaculatus.*
Fig. 9. *Camptocladius byssinus.*
Fig. 10. *Corynoneura similis.*



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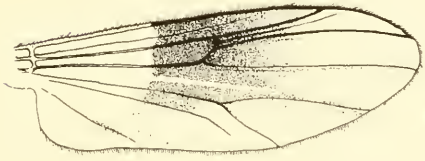

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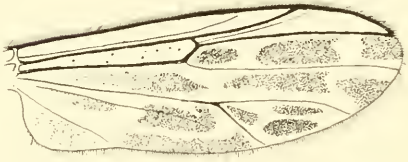

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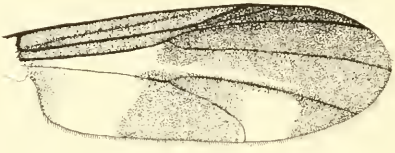

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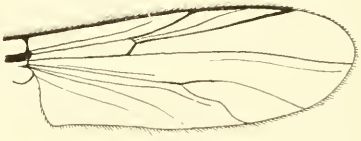

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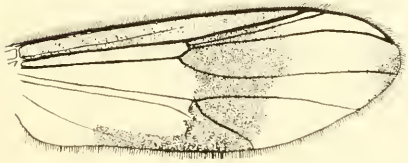

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J.R.Mallock '20

Plate XXXVI

Hypopygia of Chironomina

Fig. 1. *Chironomus fusciventris*, one side.
Fig. 2. *Tanytarsus nigripilus*.
Fig. 3. *Chironomus griseus*, one side.
Fig. 4. *C. claripennis*, one side.
Fig. 5. *Tanytarsus confusus*, one side.
Fig. 6. *Tanytarsus divcs*, one side.
Fig. 7. *Chasmatonotus bimaculatus*, lateral view of apical portion of lateral arm.
Fig. 8. *Tanytarsus viridiventris*, one side.
Fig. 9. *Tanytarsus obediens*.
Fig. 10. *Chasmatonotus bimaculatus*, one side.

Plate XXXVI

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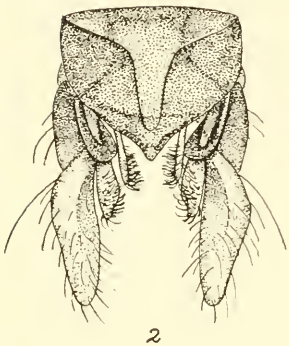

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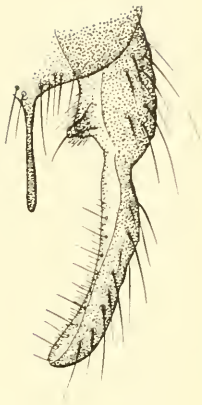

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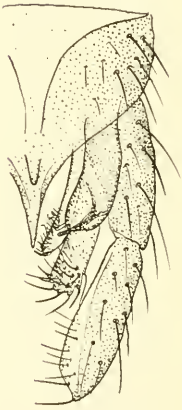

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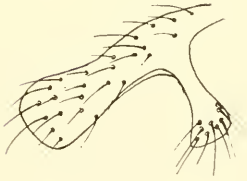

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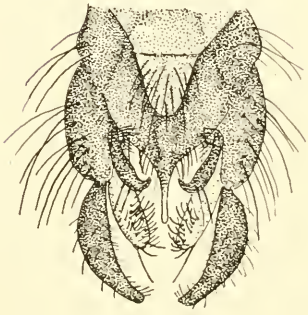

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Plate XXXVII

Hypopygial and Abdominal Details of Chironomina

Fig. 1. *Cricotopus bicinctus*, hypopygium, one side.
Fig. 2. *Cricotopus trifasciatus*, hypopygium, apical portion of lateral arm.
Fig. 3. *Orthocladius nigritus*, hypopygium, one side.
Fig. 4. *Cricotopus flavibasis*, hypopygium, one side.
Fig. 5. *Trichocladius distinctus*, hypopygium, one side.
Fig. 6. *Trichocladius distinctus*, var. *bicolor*, hypopygium, one side.
Fig. 7. *Trichocladius infuscatus*, hypopygium, one side.
Fig. 8. *Orthocladius pilipes*, hypopygium, one side.
Fig. 9. *Trichocladius politus*, hypopygium, one side.
Fig. 10. *T. striatus*, hypopygium: *a*, inner production of basal part of lateral arm; *b*, apical portion of lateral arm.
Fig. 11. *Orthocladius nivoriundus*, antepenultimate abdominal segment of male.
Fig. 12. *Orthocladius nivoriundus*, hypopygium, one side.
Fig. 13. *Dactylocladius pleuralis*, hypopygium, one side.
Fig. 14. *Psectrocladius vernalis*, hypopygium, one side.
Fig. 15. *Camptocladius flavens*, hypopygium, one side.
Fig. 16. *Pseudochironomus richardsoni*, hypopygium, one side.

Plate XXXVII

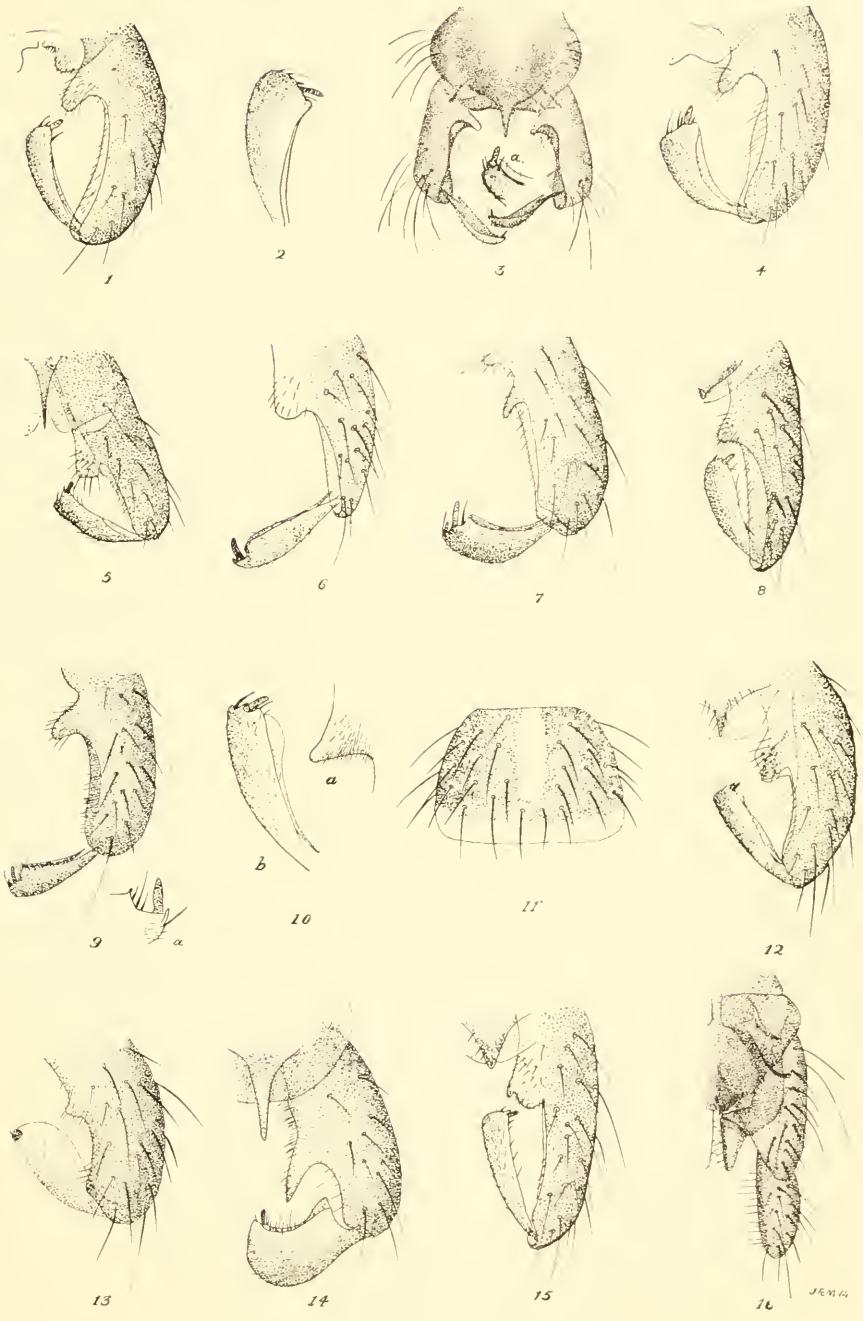


Plate XXXVIII

Details of Chironominæ

Fig. 1. *Orthocladius nivoriundus*, thoracic respiratory organ of pupa (typical).
Fig. 2. *Orthocladius nivoriundus*, thoracic respiratory organ (varietal?).
Fig. 3. *Orthocladius nivoriundus*, apical abdominal appendage of pupa.
Fig. 4. *Orthocladius nivoriundus*, lateral margin of eighth abdominal segment (varietal?).
Fig. 5. *Orthocladius nivoriundus*, lateral margin of eighth abdominal segment (typical).
Fig. 6. *Chironomus utahensis*, hypopygium.
Fig. 7. *Cricotopus trifasciatus*, portion of egg-rope.
Fig. 8. *Camptocladius lasiops*, hypopygium.
Fig. 9. *Orthocladius nivoriundus*, setula of disc of abdominal segment of pupa.
Fig. 10. *Tanytarsus* sp.?, malformed labium.
Fig. 11. *Camptocladius byssinus*, antennal flagellar joint of female.
Fig. 12. *C. flavens*, palpus of female.
Fig. 13. *Chironomus* sp. C, head of pupa from above.
Fig. 14. *Camptocladius flavens*, antennal flagellar joint of female.
Fig. 15. *Camptocladius lasiophthalmus*, antennal flagellar joint of female.
Fig. 16. *C. flavens*, apex of abdomen of female.
Fig. 17. *C. byssinus*, apex of abdomen of female.

Plate XXXVIII

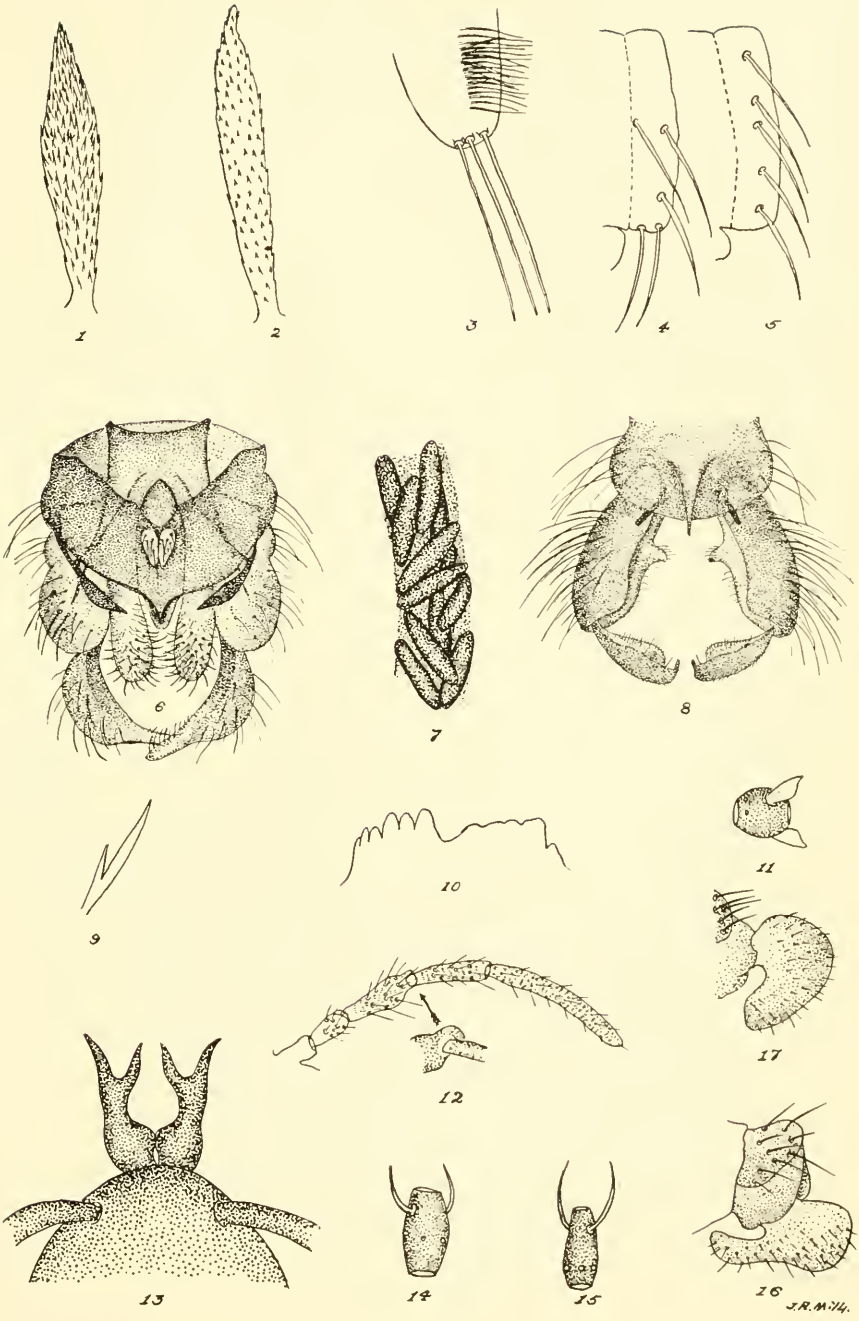


Plate XXXIX

Wing Details and Segments of a Pupa of Chironomina

Fig. 1. *Chironomus pseudoviridis*, apex of wing.
Fig. 2. *Trichocladius infuscatus*, apex of wing.
Fig. 3. *Trichocladius striatus*, apex of wing.
Fig. 4. *Chironomus viridis*, apex of wing.
Fig. 5. *Dactylocladius brevinervis*, apex of wing.
Fig. 6. *Camptocladius lasiops*, apex of wing.
Fig. 7. *Psectrocladius sordens*, wing.
Fig. 8. *Camptocladius aterrimus?*, apex of wing.
Fig. 9. *Tanytarsus dives*, segments 2–6 of pupa (after Johannsen).
Fig. 10. *Chironomus maturus*, apex of wing.
Fig. 11. *Orthocladius pilipes*, section of wing venation showing cross vein.
Fig. 12. *Orthocladius subparallelus*, section of wing venation showing cross vein.
Fig. 13. *O. flavoscutellatus*, section of wing venation showing cross vein.
Fig. 14. *Trichocladius nitidus*, cubitus of wing.
Fig. 15. *Chironomus griseus*, apex of wing.
Fig. 16. *Camptocladius flavens*, wing.
Fig. 17. *Metriocnemus brachyneura*, wing.

Plate XXXIX

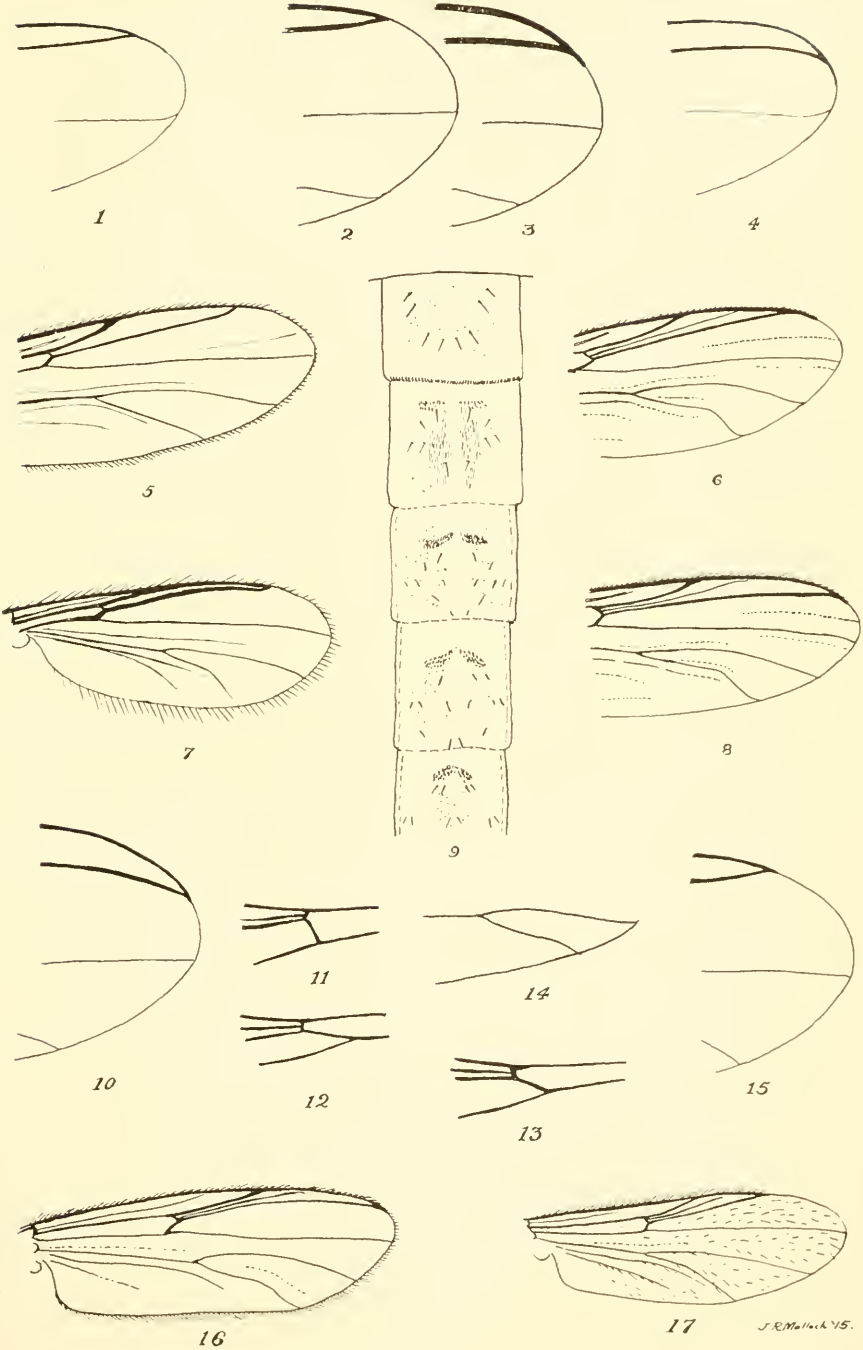
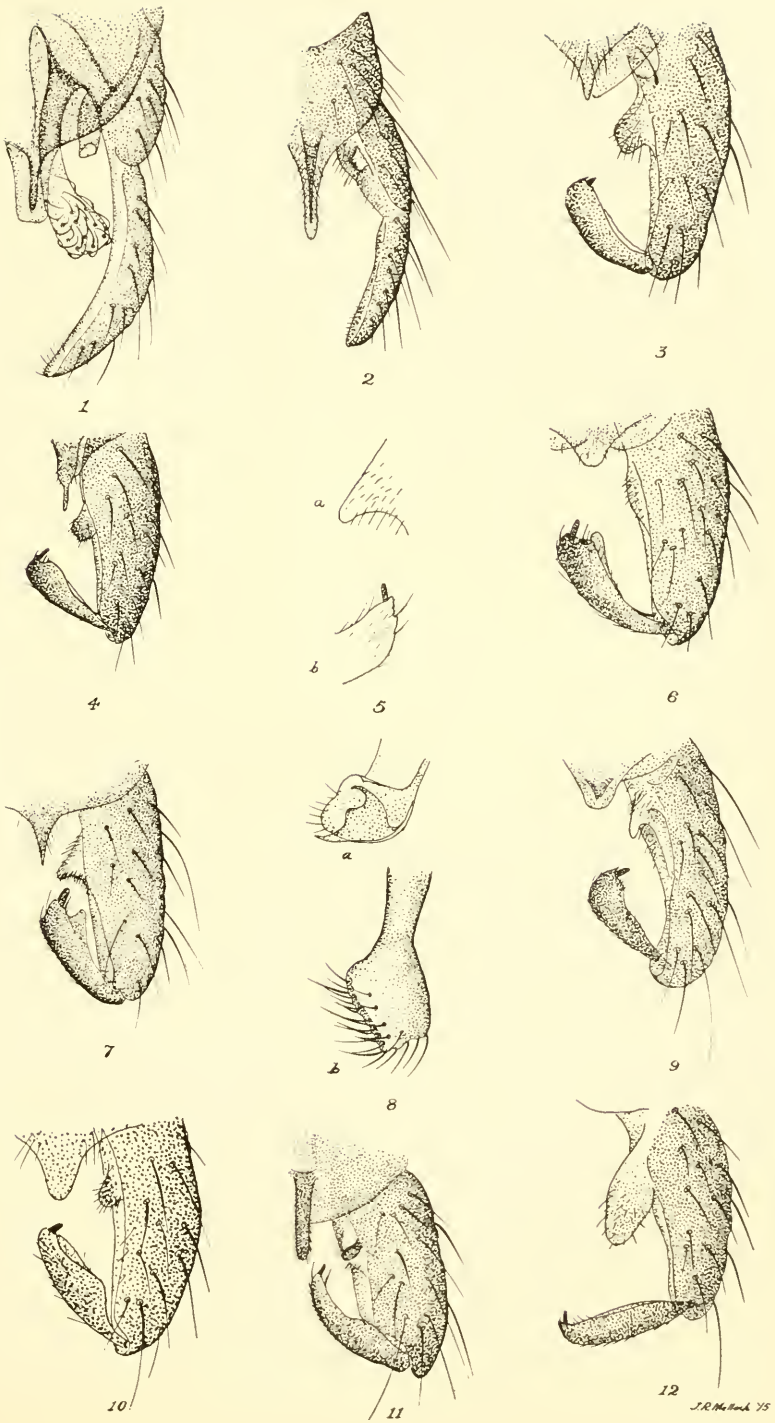


Plate XL

Hypopygia of Chironominæ

Fig. 1. *Chironomus incognitus*, one side.
Fig. 2. *Chironomus curtilamellatus*, one side.
Fig. 3. *Camptocladius subaterrimus*, one side.
Fig. 4. *Metriocnemus brachyneura*, one side.
Fig. 5. *Camptocladius flavens: a*, inner process of basal portion of lateral arm; *b*, apex of apical portion of lateral arm.
Fig. 6. *Orthocladius subparallelus*, one side.
Fig. 7. *Trichocladius nitidus*, one side.
Fig. 8. *Tanytarsus similatus: a*, superior process; *b*, inferior process.
Fig. 9. *Camptocladius aterrimus*, one side.
Fig. 10. *Orthocladius flavoscutellatus*, one side.
Fig. 11. *Camptocladius byssinus*, one side.
Fig. 12. *Dactylocladius brevinervis*, one side.

Plate XL



BULLETIN

OF THE

ILLINOIS STATE LABORATORY

OF

NATURAL HISTORY

URBANA, ILLINOIS, U. S. A.

STEPHEN A. FORBES, PH.D., LL.D.,
DIRECTOR

VOL. XI. DECEMBER, 1915 ARTICLE IV.

SOME ADDITIONAL RECORDS OF CHIRONOMIDÆ FOR ILLINOIS AND NOTES ON OTHER ILLINOIS DIPTERA

BY

JOHN R. MALLOCH

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ARTICLE IV.—*Some Additional Records of Chironomidæ for Illinois and Notes on other Illinois Diptera.* By J. R. MALLOCH.

In a previous paper, Article 6 of Volume X of this Bulletin, I indicated that despite the fact that our state list of species of *Chironomidæ* is larger than any list yet published for any other state in the Union it could not be considered as a complete list of all the species occurring in Illinois. The greater portion of the material upon which the previous paper was based consisted of species collected by Mr. C. A. Hart and the writer during 1914, and containing, as it did, but a small series of collections from a number of scattered localities it could not be expected to include all of our species. Being aware of this fact and desirous of obtaining as many species as possible, the writer during the present year has devoted most of his spare time to collecting in the vicinity of White Heath, on the Sangamon River, with a view to completing the series of *Ceratopogoninæ* in the collection in so far as that particular locality is concerned. No material from this part of the Sangamon River was contained in that previously studied, though many of the species were obtained near Monticello, which is but a few miles down river from this point.

An attempt was also made to discover what species attacked man and at what particular time and in what situations. The writer endured considerable discomfort in his investigations, as mosquitoes were very numerous and bit very severely upon every occasion that he visited the river. In addition to the mosquitoes the writer had upon one occasion the experience of being bitten by the nymph of a capsid. It is not possible at present to determine the species of this insect beyond the fact that it is certainly not *Lygus pratensis*—a species which I have seen in the act of biting at Chain Bridge, Va., and which is recognized as having that proclivity.

Another source of annoyance was provided by the females of a small black bee (*Halictus* sp.), which persistently settled upon the bare arms, evidently attracted by the perspiration. On two days this species occurred in fair numbers and was very annoying, settling on the arms and being with difficulty brushed off. Judging from the actions of the insects they were sucking up the small particles of perspiration.

The worst discomfort experienced during 1915 at White Heath was that provided by "chiggers" (*Trombidium* sp.), which were in abundance—an unusual occurrence in this part of the state.

As the collection of *Chironomidæ* was but an incident in a rather overcrowded program, I found it impossible to do any work on the early stages of the aquatic forms, and the additional data obtained refer only to the habits of the imagines and to certain species which are either new to science or are not included in my previous paper.

Notes on Blood-sucking Ceratopogoninæ

In my previous paper I listed as blood-sucking species, *Culicoides varipennis, C. sanguisugus, C. hæmatopotus,* and *C. guttipennis,* the first two biting both man and cattle, the third biting man, and the last biting a horse. Before listing my records for this year it may be of interest to mention those given by Pratt in 1907 for this group*.

He lists six species as blood-sucking, viz., *Ceratopogon guttipennis, C. sanguisuga, C. stellifer, C. varipennis, C. cinctus,* and *C. unicolor.* All of these species were described by Coquillett, who placed them in the genus *Ceratopogon* (sens. lat.). All but *unicolor* belong to *Culicoides.* The generic position of *unicolor* is uncertain. It will be seen from a comparison of the two lists that four species recorded by Pratt are also in the Illinois list. This year, I have been able to find several additional biting species.

Culicoides guttipennis Coquillett†

In 1914 I did not succeed in obtaining specimens of this species attacking man, although well aware that it was considered as one of the most persistent biters in the genus. This year, however, upon different dates, I have obtained a large number of specimens in the act of biting. I found that by exposing the bare arm and settling quietly down by the side of the river I could readily obtain any number of specimens of this species. The exposed part, however, was not most subject to attack, as the insects appeared to settle much more readily upon the clothes, especially upon the legs, and almost invariably made their way up between the legs, or, when one was in a sitting posture, directed their efforts towards the under surface and particularly at the back of the knee if the leg were drawn up. It is obvious, of course, that in

*"Notes on 'Punkies'," Some Miscellaneous Results of the Work of the Bureau of Entomology—IX, Bull. 64, Part III, Bur. Ent., U. S. Dept. Agr. pp. 23–28.

†Citation to original publication is given only when species is not included in my previous paper.

attacking cattle the most vulnerable portions are best calculated to yield the best results to these small insects with their rather short mouth-parts, and that the most vulnerable parts are those near the upper extremities of the legs. I have found in the case of *Simuliidæ*, or black flies, that while they may be found upon almost any part of the body of a cow or horse they are more often found on the under surface of the body close to the leg or, in the case of the horse particularly, inside the ear—the most vulnerable spots.

The blood-sucking species of *Ceratopogoninæ* are mostly crepuscular in habit, and in most cases I found that during May and June the greatest numbers occurred after five o'clock in the afternoon, continuing active until 8 p. m. at least, this being the latest hour that it was possible for me to make observations. From experience at other times and in other localities I know, however, that the insects bite as late as 10 p. m. The earliest hour at which I found *guttipennis* biting was 1 p. m. On this occasion the sun was shining, but an hour or so later a short thunder storm occurred, the weather conditions very probably being responsible for the unusual occurrence of the species.

When in the act of biting it was not always easy to capture this species in a cyanide vial, as the insects were very readily disturbed, which is not the case with the smaller species, *biguttatus* and *sanguisugus*.

May 9, only one specimen was taken; on May 15 but two; while on May 30, thirty-five specimens were collected, all in the act of biting. On the first two dates *biguttatus* was the commonest species. On various dates in June and July *guttipennis* was found to occur commonly, but no large collection was made.

In my paper previously referred to I stated that the early stages of *guttipennis* were undescribed. Lest there should be any misunderstanding on this point it may be pertinent to indicate that meaningless figures of the larva and pupa accompanied by absolutely inadequate descriptions are given by Pratt in his paper referred to on a previous page.

Culicoides stellifer Coquillett

Two specimens of this species were taken in the act of biting the writer, August 8, 1915, on bank of Sangamon River, near White Heath.

Culicoides sanguisugus Coquillett

This species is found commonly in Urbana, large numbers of both sexes being taken on windows of stores in the city after the lights are turned on. I have also taken many specimens on the inner side of win-

dows of the Natural History Building of the University of Illinois, especially in the basement on windows close to the outer doors. Only three specimens of the species were taken in the act of biting on the dates that collections were made at White Heath, two of these being taken at the Sangamon River May 30, and the other at the railroad station in the town over a mile from the river. It appears from the rate of occurrence of this species in our collections that *sanguisugus* is more common in towns than *guttipennis* or *varipennis*.

Culicoides hæmatopotus Malloch

This species occurred along with *guttipennis* but in smaller numbers. It was taken biting on May 6, 9, and 30, and June 6. Some specimens were taken on windows of the Natural History Building also. Its biting habits are similar to those of *guttipennis*. The bite of both is less severe than that of *varipennis*.

Culicoides biguttatus Coquillett

Ceratopogon biguttatus Coquillett, Proc. U. S. Nat. Mus., Vol. 23, p. 604.

This species is an addition to the Illinois list, the only specimens I had when I wrote my previous paper being from Virginia.

As an aid to the identification of the species it is necessary to indicate that in my key to the Illinois species* *biguttatus* will run down to No. 6. To include it, it is necessary to change the wording to read as follows:

6. Spots on wings indistinct; mesonotum without well-defined markings 6a
— Spots on wing rounded, clearly defined; mesonotum with well-defined brown markings 7
6a. Wings with only 2 clear spots, one over cross vein and the other at apex of third ..... *biguttatus*.
— Wings with several ill-defined clear marks in the posterior and anal cells along wing margin in addition to those over cross vein and at apex of third ..... *sanguisugus*.

Coquillett originally described *biguttatus* from specimens obtained in the District of Columbia. In Illinois the species occurred on the same dates as *guttipennis* and at the same place. The largest number taken biting on any one day was thirteen on May 15. This species attaches itself more firmly to the skin than does *guttipennis* and can be taken much more easily by inverting the cyanide vial over it when in

*Bull. Ill. State Lab. Nat. Hist., Vol. 10, Art. 6, p. 296.

the act of biting. In some cases the specimen succumbed to the fumes without relaxing its hold and had to be pried off. I took a single female on a window in the Natural History Building at Urbana July 25, 1915.

Pseudoculicoides griseus Coquillett

Ceratopogon griseus Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 602.

A single specimen of this species was taken biting, on the bank of Sangamon River near White Heath on May 9.

I have a suspicion that the species which I described as *P. major** may be synonymous with *griseus*, but desire to obtain further material before definitely deciding, as I am of the opinion that there are several closely allied species in this genus, the differentiation of which will require careful study of a large amount of material.

There is no previous record of *griseus* biting man.

Ceratopogon peregrinus Johannsen

July 7, while collecting on tree trunks and limbs after a period of rain, I discovered a dead worm lodged on a branch of a cypress tree, its location and condition indicating that it had been dropped by a bird. When first seen there were several specimens of *Ceratopogon peregrinus* engaged in feeding upon it in company with a species of *Aphiochæta* and a female of *Lonchæa polita* Say. This occurred about noon, and about a dozen specimens in all were taken. One specimen that had just arrived and had only begun to feed, had the abdomen normal in size, but those that had been feeding for some time had the abdomen greatly distended. It was observed that all the specimens were females, and in one case the insect was seen inserting its proboscis in the minute drops of moisture on the leaves.

This species is very common both indoors and outdoors throughout the locality collected over, but no records of feeding habits other than the above have been obtained. An attempt was made to ascertain if the species would bite man by confining the females on the bare skin of the arm, but although this method has proven successful with some *Simuliidæ* that are not particularly prone to that habit it was unsuccessful with *peregrinus*. It may be of interest to mention that attempts to persuade several species of *Forcipomyia* to bite by allowing them to settle on the hands and arm and also by confining them on the skin by inverting a vessel over them, proved failures. I have not discovered any species of this genus attacking man or cattle.

*Loc. cit., p. 311.

Additions to List of Illinois Chironomidæ

Several of the species which were taken this year are new to science; others are new to the state list; while in some cases the males of known species are described herein for the first time, and in one instance the female is thus dealt with. In all instances care has been taken to indicate the characters by means of which the additions to our list may be separated from those already recorded by the writer. In considering the number of additions to the Illinois list it is necessary to include *Culicoides biguttatus* previously mentioned.

CERATOPOGONINÆ

Neoceratopogon, n. gen.

This genus is erected for the reception of *Ceratopogon bellus* Coquillett, a species unknown to me when my previous paper was written.

Generic characters: male.—Eyes narrowly separated above; antennæ elongate, plumose, apical 3 joints much longer than the preceding flagellar joints; legs slender; third hind tarsal joint short, slightly longer than fourth, the latter obcordate and with the third very slightly longer than fifth; claws small, slender, simple, subequal; empodium indistinguishable; wings with distinct hairs as in *Ceratopogon;* first and third veins fused, not connected by a cross vein as in *Ceratopogon;* media petiolate.

Female.—Eyes narrowly separated above; antennæ elongate, basal flagellar joints elongate, not nearly transverse as in *Ceratopogon,* apical five joints distinctly longer than preceding joints; tarsal claws unequal in size, the inner twice as long as the outer.

Type of genus, *Ceratopogon bellus* Coquillett.

Neoceratopogon bellus Coquillett

Ceratopogon bellus Coquillett, Proc. U. S. Nat. Mus., Vol. 25, 1902, p. 87. ♂

Female.—Yellowish white, opaque. Face brownish; upper part of head covered with white pruinescence; antennæ elongate and mouth parts brownish or yellowish. Disc of mesonotum covered with whitish pruinescence; a small brown spot at base of each discal hair; scutellum whitish, a black or brown streak on center; postnotum yellow. Abdomen yellowish or white above, fuscous on venter. Legs white, marked with fuscous or brown as follows: entire coxæ and trochanters, a broad median band on all femora and a very narrow one at apices; a narrow band near base on all tibiæ, a broad median band on fore pair,

a narrow one beyond middle on mid pair, a narrow one before and another beyond middle on hind pair, and the apices of all pairs, apices of tarsal joints, and whole of basal joint of hind tarsi. Wings with 8 small deep black spots as follows: on cross vein (sometimes paired), at apex of third vein, below middle of petiole of cubitus, near base of posterior branch of media and near apices of each branch of that vein and of cubitus. Halteres whitish, knob with a black spot.

Antennæ about 1.5 as long as head and thorax combined. Thoracic dorsum and scutellum with sparse rather long hairs. Legs slender; basal joint of hind tarsi slightly shorter than the remaining joints combined.

Male.—Agrees with the female in color.

Hypopygium large, projecting apical portion of lateral arm slender, curved.

Length, 1–1.5 mm.

Illinois locality, Urbana, July 5–7, 1915, several females at rest on cypress tree on university campus, one in Natural History Building, and one male on cypress tree; one female August 27, on cypress tree (J. R. Malloch).

This genus will run down to the second section of caption 3 in the key to genera of *Ceratopogoninæ* in my paper, and may be separated from *Ceratopogon*, the genus there included, by the fusion of the first and third veins of the wing, the absence of empodia, and the unequal tarsal claws in the female.

The early stages are unknown.

Forcipomyia elegantula, n. sp.

Female.—Pale yellow, marked with deep black. Head yellow, upper portion of back of head and the antennal flagellum fuscous, eyes black. Mesonotum slightly shining, with 3 glossy black vittæ, the median one bifid posteriorly and ending slightly beyond middle of disc, the lateral pair abbreviated and conspicuously broadened anteriorly, not extending to posterior margin; pleuræ with 3 shining black spots, one between fore and mid coxæ, directly above it, the upper extremity of which does not reach upper margin of pleuræ, and a third below wing base; scutellum and postnotum glossy black. Abdomen slightly shining, dorsum with anterior half of segments 2–5 and the whole of segment 6 blackened; venter yellow, blackened at apex. Legs whitish yellow, apical fourth of hind femora deep black. Wings grayish, surface hairs fuscous with the exception of a rather large patch over the apex of the third vein which is yellowish white. Hal-

teres pale yellow. Hairs on body and legs yellow, lanceolate hairs on the latter fuscous.

Eyes distinctly separated above; antennal flagellum with basal joints moniliform, sensory hairs of moderate length, thicker than the ordinary surface hairs. Mesonotum and scutellum with rather numerous long hairs. Legs with conspicuous hairs, all tibiæ with a dorsal series of lanceolate upright scales; basal joint of hind tarsi one fifth shorter than second; empodia distinct. Third vein ends at middle of wing.

Male.—Agrees in color with female.

The legs are devoid of the lanceolate hairs; the apical 4 antennal joints are elongated; the hypopygium is large and very similar to that of *specularis;* in other respects similar to female.

Length, .75 mm.

Type locality, Urbana, Ill., June 28, and August 5, 1915, taken on window in basement of Natural History Building, University of Illinois, by the writer. Allotype, August 12, 1915; same situation.

The type specimen has a large mite about two thirds as long as the abdomen, firmly attached to it near the base.

The female of this species will run down to caption 3 in my key to the Illinois species of this genus (p. 312), but may be readily separated from both species therein by the difference in coloration, and from *ciliPes* by the possession of lanceolate scales on the fore tibiæ. The male can be separated from all others in my preceding paper by the yellow thorax with its conspicuous glossy black vittæ.

One female had a number of extruded eggs attached to the apex of abdomen. They are white, about three times as long as thick, slightly rounded at the extremities, and slightly curved in outline. They are closely attached to each other on their longer sides.

Euforcipomyia, n. gen.

Distinguished from *Forcipomyia* by having the basal joint of hind tarsi much longer than the second, and from *Pseudoculicoides* by the different structure of the antennæ, which is similar to that of *Forcipomyia.* In *Pseudoculicoides* the antenna of the female has the flagellar joints very appreciably constricted at apices, especially the apical 5, while in *Forcipomyia* and the present genus the joints are but slightly constricted and for a very short distance, never having a conical appearance as in *Pseudoculicoides.*

The wings are densely haired, but the hairs are slender and rather upright, more resembling those on the wings of *Pseudoculicoides* than on *Forcipomyia.* The first vein runs close to the third and is con-

nected with it by a cross vein and the media is petiolate. Empodia distinct.

Type of genus, *Euforcipomyia hirtipennis*, n. sp.

Key to Species

1. Basal joint of hind tarsus not twice as long as second (22 : 15) .... *hirtipennis.*
— Basal joint of hind tarsus at least twice as long as second 2
2. The short joints of antennal flagellum longer than broad, distinctly narrowed at bases, the segmentation very distinct; basal joint of hind tarsus twice as long as second (40 : 20) ..... *longitarsis.*
— The short joints of antennal flagellum broader than long, closely fused, the segmentation indistinct; basal joint of hind tarsus about 2.5 times as long as second (37 : 15) ..... *fusicornis.*

Euforcipomyia hirtipennis, n. sp.

Female.—Black, shining; abdomen more brownish, subopaque. Antennæ and mouth parts brownish. Legs yellow. Wings slightly grayish, covered with brown hairs. Halteres yellow. Hairs throughout on body and legs yellow.

Eyes slightly separated; antenna longer than head and thorax combined, the divisions between joints distinct throughout, basal 9 flagellar joints subequal in length, distinctly but not greatly longer than broad, hairs of moderate length, sensory organs longer than length of joints, slightly curved, apical 5 joints elongated, stout, their combined lengths less than that of basal 9, apex of last joint produced in the form of a short thorn. Thorax with long and rather sparse slender hairs, those on margin of scutellum very long. Abdomen with sparse short hairs. Legs of moderate strength; hind tibia and hind tarsus subequal in length; basal joint of hind tarsi about 1.5 as long as second (22 : 15); third joint slightly shorter than fourth, fourth and fifth subequal; claws small, subequal, simple; empodium as long as claws, fringed; surfaces of femora and tibiæ with numerous long hairs. Third vein ending a little beyond middle of wing, first ending one third from apex of third, connected with the latter by a cross vein at its middle; media with very short petiole, base of posterior branch indistinct; surface of wing with numerous microscopic upright hairs in addition to the long subdepressed hairs.

Length, .5 mm.

Type locality, Urbana, Ill., June 30, 1915, taken by the writer on the windows of the basement of the Natural History Building.

Nothing is known of the early stages or of the habits of the imago.

Euforcipomyia longitarsis, n. sp.

Female.—Fuscous. Mesonotum shining; pleuræ reddish brown. Legs testaceous or yellowish. Hairs on body and legs yellow; on wings brown.

Eyes contiguous; antenna about as long as head and thorax together, basal joints of flagellum longer than broad, narrowed at bases and more distinctly so at apices, apical 5 joints elongated; palpi 5-jointed. Mesonotum with pale decumbent hairs, those on lateral and posterior margins very long; scutellar hairs numerous, long and conspicuous. Abdomen with pale yellow hairs, those near the posterior lateral angles very long. Legs of moderate strength, with numerous slender hairs, those on dorsal surface of tibiæ very long; hind tibia about three fourths as long as hind tarsus; basal joint of hind tarsi twice as long as second, proportions of the first three joints, 40, 20, 15; empodium as long as claws. Wings densely haired throughout their entire surface; costa ending slightly before middle of wing; first and third veins almost fused basally, the former ending about two fifths from apex of latter; cubitus forking slightly beyond apex of third vein.

Length, .75 mm.

Type locality, Urbana, Ill., August 24, 1915, on basement window in Natural History Building, University of Illinois (J. R. Malloch).

Early stages and habits of adult unknown.

Euforcipomyia fusicornis Coquillett

Ceratopogon fusicornis Coquillett, Jour. N. Y. Ent. Soc., Vol. 23, 1905, p. 63.

Female.—Differs from *hirtipennis* in having the mesonotum with distinct brownish pruinescence, the antennæ almost black, and the legs brownish.

Eyes distinctly separated above; antenna not longer than head and thorax combined, basal joints of flagellum very distinctly shorter than broad, rather closely fused; apical five joints elongated. Mesonotum with sparse subdepressed golden hairs and a few longer upright ones intermixed. Legs of moderate strength; basal joint of hind tarsi about two and a half times as long as second (37: 15), third distinctly shorter than second, fourth shorter than fifth; claws small, simple, equal; empodia as long as claws, fringed. Third vein ending distinctly beyond middle of wing, first slightly beyond middle of third, third and first almost fused; otherwise wings as in *hirtipennis*.

Length, .5 mm.

Type locality, Florida. I have seen a specimen from Beltsville, Md., July 4, 1915 (W. L. McAtee), which was taken attacking *Chauliodes* sp.

This species resembles rather closely some species of *Ceratopogon* but differs noticeably in possessing the long surface hairs in addition to the short upright ones on the wings. Several species of *Forcipomyia* have been recorded as attacking insects, and in the present paper I record a species of *Ceratopogon* feeding upon a worm.

Fusicornis has not been taken in Illinois and is added here for convenience of reference.

Johannsenomyia albibasis, n. sp.

Female.—Glossy black. Head black, face yellow, palpi pale yellow, proboscis reddish yellow. Thorax entirely glossy black, without pruinescence and with inconspicuous dark hairs which are very sparse on center of mesonotum. Abdomen shining, black apically, the basal 2 or 3 segments whitish. Legs yellowish white, blackened narrowly on fore knees and apices of fore and mid tibiæ, broadly on apices of mid and hind femora and hind tibiæ, the latter sometimes with dark suffusion to near base, apical joint of all tarsi black. Wings clear, veins of the basal half very pale, darker from middle to apex. Halteres yellowish, knob black.

Eyes distinctly separated above, antenna slightly longer than head and thorax together, second joint not much swollen, basal eight joints of flagellum distinctly longer than broad, apical five joints much more elongated than preceding joints. Legs slender, without spines or setulose hairs; fifth tarsal joint on all legs with 4 or 5 pairs of rather long ventral spines; tarsal claws long, subequal, each with short subbasal tooth. Wings of moderate width; third vein ends about one fifth from apex; first ends at two fifths from base of third, its last section distinctly shorter than the preceding one; media forks before cross vein; cubitus slightly beyond cross vein.

Male.—Differs from the female in having the antennæ yellowish, with dark plumes; the coxæ brownish, and the fore knees more noticeably blackened; the third vein ending slightly over three fourths from base of wing; the fifth tarsal joint without ventral spines; the tarsal claws much smaller and without the subbasal tooth.

Length: female, 2.5 mm.; male, 2 mm.

Type locality, White Heath, Ill., May 8–30, 1915 (J. R. Malloch).

This species will in the case of the female run down to section 13 in my key to the species of this genus in my recently published paper on the Chironomidæ of Illinois*, but is readily separated from the two species there given by the color. The male will run down to section 8 in the same key, but may also be separated from the two species with dark halteres by the color as well as several structural characters.

The species was very common at rest on the under side of leaves of trees and bushes bordering the Sangamon River. The male bears a striking resemblance to that of *Probezzia pallida* which occurred along with it.

PROBEZZIA INFUSCATA, n. sp.

Female.—Head black, face, proboscis, and palpi brownish yellow; basal half of antennæ pale yellow, apical half fuscous. Thorax glossy black, without any traces of pruinescence. Abdomen white or creamy, apical half infuscated except the 2 apical segments, which are whitish. Legs yellow, mid and hind coxæ fuscous, apical two fifths of femora, entire tibiæ, and apical two tarsal joints of all legs black. Wings, including the veins, whitish on basal half, apical half slightly infuscated, the veins blackish. Halteres brown, knobs black. Antennal hairs pale; thoracic setulæ black.

Eyes distinctly separated; second antennal joint rather small; basal flagellar joint nearly twice as long as second, all flagellar joints conspicuously longer than their diameter, entire length of antenna about one and a half times as long as head and thorax combined. Thoracic dorsum smooth, setulæ short and sparse; scutellar bristles short. Abdomen stout, without noticeable hairs. Legs slender, femora slightly swollen on apical third; tibiæ with rather noticeable setulose hairs; fourth tarsal joint of all legs obcordate; fifth joint with two series of ventral bristles; claws of moderate size, subequal, each with short subbasal tooth. Third vein ending slightly before apex of wing, first at two fifths from base of third; cubitus forking slightly proximad of cross vein.

Male.—Agrees with the female in color except that the abdomen is blackened from the base of third segment to apex with the exception of the hypopygium, which is yellowish. The wings are also less noticeably infuscated. The antennal plumes are yellowish white.

The second antennal joint is considerably larger than in the female and black in color. The fifth tarsal joint has no spines on the ventral surface; the claws are smaller and have no subbasal tooth. The third vein ends at five sixths the wing length, the first beyond middle of third, and cubitus forks under the cross vein.

*Bull. Ill. State Lab. Nat. Hist., Art. 6, Vol. 10, May, 1915.

Length: female, 4.5 mm.; male, 3–3.5 mm.

Type locality, White Heath, Ill., on bank of Sangamon River, May 9, 16, and 30, 1915 (J. R. Malloch).

The female of this species will run down to section 8 in my key to the species of *Probezzia* in the paper previously mentioned, and may be separated from *albiventris*, the only other described species with black halteres, by the infuscated abdomen, differently colored legs, and infuscated wings. The male will run down to section 14, and is readily separated from the species included therein by the dark halteres. The male of *albiventris* is not known, but must closely resemble that of *infuscata*.

The early stages and the habits of the imago are unknown.

TANYPINÆ

Tanypus carneus Fabricius

The only Illinois records I had of this species when I wrote my paper was that of a larva from the Illinois River. On June 18, 1915, I took a male imago on a window in the basement of the Natural History Building of the University of Illinois, at Urbana, which agrees with the description of the species in almost all respects, the only departure being in the color of the abdomen, which has a broad dark brown anterior band on all segments but the fourth, the latter being entirely whitish yellow. Single examples of the female were taken on July 21 and August 13. I have no doubt as to the identity of the species.

Descriptions of Males of Ceratopogoninæ previously unknown

Johannsenomyia argentata Loew

Male.—Glossy black. Head black, basal portion of flagellum of antennæ and their plumes fuscous, the latter with a whitish luster when viewed from certain angles; mouth parts brownish. Mesonotum without distinct pruinescence. Abdomen in some specimens with a faint hoary pruinescence when viewed from behind. Legs yellowish, mid and hind coxæ, apices of fore femora narrowly, of mid femora broadly, and almost the whole of hind femora, blackened, as also are the bases and apices of fore and mid tibiæ, the entire hind tibiæ, the apices of the basal four tarsal joints, and the whole of the fifth joint of all legs. Wings slightly grayish, radius and basal portion of upper fork of media blacker than other veins. Halteres black.

Eyes distinctly separated above; antennæ extending to beyond middle of abdomen. Hypopygium small, recurved, apical portion of lateral arm short and stout. Legs slender; fifth tarsal joint of hind legs with 2–3 pairs of ventral thorns, the other legs unarmed; tarsal claws short, subequal, with short basal tooth. Third vein ending at about four fifths the wing length, first slightly before middle of third.

Length, 2.5 mm.

Locality, White Heath, Ill., May 30, and July 11, 1915, on bank of Sangamon River (J. R. Malloch). I have also taken females of this species at White Heath June 26 and July 11, and Mr. Hart took it at St. Joseph June 27, 1915, neither of these localities being included in my previous paper.

The male of this species was unknown when I wrote my paper on the family, and this is the first published description of that sex. In my key to the genus it will run down to section 13; and from both the species contained therein it may be separated by the long antennæ and by its having only the hind tarsi with the fifth joint spined ventrally.

Probezzia pallida Malloch

Male.—Head brownish, eyes black, antennæ yellowish, plumes pale yellow, mouth parts almost white. Thorax varying from dark brown to deep black, shining. Abdomen white, apical half black or brown, hypopygium yellow. Legs almost white, last tarsal joint black. Wings white, veins pale yellow. Halteres yellow.

Eyes separated above; antenna longer than head and thorax combined. Mesonotum with four longitudinal rows of rather strong upright setulose hairs. Hypopygium rather large, not recurved, apical portion of lateral arm shorter than basal, strong and stout, clawlike. Legs of normal strength; fifth tarsal joint unarmed; claws small, subequal, simple. Third vein ending about four fifths from base of wing, first slightly before middle of third.

Length, 1.5 mm.

Locality, White Heath, Ill., May 9 and 16, 1915 (J. R. Malloch). A large series of this sex was taken on the under side of leaves of bushes and trees on the bank of the Sangamon River on the last-named date. The day was very windy, and the insects were resting on the sheltered side of the plants. I took two females also at White Heath on May 16, one of them from a spider's web; it was still alive when taken.

The male of *pallida* will run down to section 10 in my key to the species of this genus. It may be separated from all the species therein

by the fact that the legs are whitish and the fifth joint of all tarsi deep black. The other six species all have a greater proportion of the legs blackened.

I had a slight doubt about the identity of this sex as the male of *pallida* when I wrote the description, but since then I have examined a series of both sexes which were reared by Mr. R. A. Muttkowski from larvæ obtained in Wisconsin, and find that despite the unusual difference in color it is undoubtedly the male of *pallida*. I understand from Mr. Muttkowski that he is preparing descriptions of the early stages of this and several other species for publication.

Immature Stages of some Illinois Diptera, and Biological Notes

Not infrequently larvæ or pupæ of *Diptera* are submitted to the office of the State Entomologist for identification, and quite often it has been impossible for those in charge of this branch of the work to give names for the species involved. The immature stages of *Diptera* are comparatively little known, and very often entomologists who have succeeded in rearing species from either the larval or pupal stage neglect to make descriptions that will serve to identify the species in these stages upon any subsequent occasion; or the written description or figures are so inaccurate or vague that they serve only to give a general idea of the appearance of the species. It is the purpose of the present writer to describe in detail a number of species which have been reared by members of the office staff here or by himself, and to figure the principal features of each so that it may be possible for students to recognize the species when occasion arises.

Of the species described herein, *Psilocephala hæmorrhoidalis* Macquart is predaceous on wireworms, while the species of *Asilidæ* and *Mydaidæ* are also predaceous upon subterranean larvæ, and are of considerable economic importance. The species of *Mydaidæ* is predaceous upon larvæ which burrow in rotten tree-stumps. The species of *Bombyliidæ* dealt with are parasites, those of *Anthrax* being recorded as internal parasites upon *Lepidoptera; Exoprosopa fascipennis* is parasitic upon *Tiphia* spp., which are themselves parasitic in larvæ of *Lachnosterna* spp.; *Spogostylum anale* and *Sparnopolius fulvus* are ectoparasitic upon larvæ of *Cincindela* and *Lachnosterna* respectively. The habits of *Exoprosopa fasciata* are not known to me, while no record is available that indicates whether *fascipennis* is an internal or external parasite. The species of *Mycetophilidæ* described, *Mycetobia divergens*, has been recorded as attacking the trunks of fruit trees, but

it certainly does not do so unless there is an injury, and then it feeds, not upon the wood but upon the exuding sap and attendant fungus. The genus is of interest, however, because it is an exception to the general rule in *Mycetophilidæ* in respect to its respiratory system. A description of the larva and pupa of a species of *Sciara* is given herein which serves to show the differences between the peripneustic and amphipneustic types of larvæ.

SCIARIDÆ

Sciara sp.?

Larva.—Length, 7–8 mm. White, semitransparent; head glossy black; alimentary canal showing brownish on about two thirds of its length; ventral view of head as in Figure 1, Plate LXXX; mandibles (Fig. 8) showing but slightly above maxillary lobe; antennæ in the form of a circular clear area, not protuberant; median dorsal sclerite with 14 small round clear spots arranged as in Figure 10, Plate LXXX; hypopharynx as in same figure. First ganglion enclosed in head; two tracheal trunks emanating from each side of head, connected at prothoracic spiracle (Fig. 3), there being beyond that point only one main trunk on each side; in addition to the prothoracic spiracle 9 other spiracles are present on the succeeding segments (Fig. 2), the first and last of which appear to be closed; body without surface hairs.

Pupa (Pl. LXXX, Fig. 4).—Length, 3–5 mm. Whitish or slightly yellowish. Entire body without hairs, the usual pair on upper margin of head almost indistinguishable. Prothoracic respiratory organ rounded, not raised, stigmatiform. Abdominal segments 1–7 with distinct spiracles, apical 2 without spiracles.

A number of larvæ of this species were sent here for identification from Danville, Ill., at the end of July, 1915, with the information that they had been found traveling over a path in a ropelike mass. Unfortunately an attempt to rear the species failed, so that it is not possible to give a specific identification. It is, however, evident that it is the same species recorded by Felt as occurring at Franklin, N. Y.*

The occurrence of so-called "snakeworms" in their peculiar ropelike processions has been recorded at different times by several entomologists in America, and they have been known as occurring in Europe for many years. Various causes have been assigned as responsible for the larvæ's migrating *en masse;* but the most probable cause is that of heavy or continued rain penetrating their habitat in the earth

*Sixteenth Rep. State Ent. N. Y., 1901, p. 992.

and forcing them to get to the surface in much the same manner as earthworms. Whether we have a number of species in America that are addicted to this habit, or only one, remains to be discovered. Most of the species of the family feed upon decaying vegetable matter.

MYCETOPHILIDÆ

Mycetobia divergens Walker

Mycetobia divergens Walker, Ins. Saund., Diptera, Pt. 1, 1856, p. 418.
Mycetophila persica Riley, Prairie Farmer, June 15, 1867, Vol. 35 (n. s., 5), No. 19, p. 397.
Mycetobia sordida Packard, Guide to Study of Insects, 1869, p. 388.
Mycetobia marginalis Adams, Kans. Univ. Sci. Bull., Vol. 2, No. 2, 1903, p. 21

Larva (Pl. LXXX, Fig. 12).—Length, 9–11 mm. White, semi-transparent. Head brownish, eye-spots black, surrounded by paler color. Thoracic segments with brown markings of variable extent and depth, pattern on dorsum generally as in figure; laterally the pale markings are generally in the form of an irregular vertical stripe on middle of segments and a pale posterior margin, those on prothoracic segment being usually connected on upper portions, whereas on the other two segments they are separated throughout their length; the pale markings of the lateral areas are continued over the ventral surface for a short distance, and there are also two wedge-shaped pale marks extending from the posterior margin of each segment which are usually short on the prothoracic segment and much longer and broader on the other two segments. Abdomen without brown marks.

Head about 1.5 as long as broad, tapering slightly anteriorly; labrum protruding, its ventral surface densely covered with fine downwardly directed hairs; mandibles as in Figure 11; labial plate as in Figure 13; maxillæ stout, of moderate length, with short papillæ; surface of head with a few short hairs. Prothoracic respiratory organs (Figs. 5 and 6) slightly raised above level of segment, their margins rugose; trachea connected by a stout transverse trunk at division of first and second thoracic segments; immediately behind the spiracular opening is a strong branch which is subdivided near its base, one of the divisions being directed forward, entering the head, the other directed backward; abdomen without spiracles, the lateral tracheal branches bifurcate, without the normal terminal connection with the outer wall of abdomen; apices of the two main parallel tracheal trunks slightly projecting beyond surface of last segment in life, retracted in dead specimens, their apical margins with a number of weak radiating hairs.

Pupa (Pl. LXXX, Fig. 7).—Length, 5–7 mm. Pale yellowish brown, opaque. Head with two short hairs on upper anterior margin. Prothoracic respiratory organs short and stout, situated well forward. Integument of entire pupa with microscopic reticulations. Thorax with numerous short hairs or spinules arranged as shown in figure. Abdomen with numerous stout spinules or small thorns as shown in figure, the dorsal arrangement of which is as shown in Figure 9, as is also the apical armature of abdomen; spiracles not distinguishable.

Larvæ of this species were abundant on tree trunks, where through injury the sap was exuding, at Urbana, in July, August, and September, 1915. Many imagines were reared from larvæ obtained from the trunk of a mulberry tree, and on the campus of the University of Illinois there were several elm trees on which the larvæ were common. In the case of all trees upon which I found the species it is noteworthy that there was a fungous growth over the surface where the exudation occurred, and in this the larvæ moved with considerable facility. They bear a striking resemblance to the larvæ of aquatic *Ceratopogoninæ* and progress by the same serpentine motion as do those larvæ. The larval skin is not generally entirely freed from the pupa at transformation, the apical half of the pupal abdomen being enclosed in it, the head of the larva lying close to the ventral surface of the abdomen. The pupa, just before the emergence of the imago, makes its appearance at the surface of the matter in which it is buried, having been previously visible only through the presence of the small respiratory organs, which generally pierce the upper layer of the covering. I found that the pupæ when removed from their normal position in the semi-liquid matter can regain that position by means of a rotary motion of the body, entering, tail first, until all but the apices of the thoracic respiratory organs are enveloped. Under natural conditions they pupate under the loose bark and possibly in this way cause very slight injury.

No damage is done to the trees by the presence of the larvæ so far as I can discover, and they are present only in those trees where an injury causes an exudation of sap. It is not impossible that they may have an irritating effect upon the wound other than that suggested above, but I doubt it. They feed upon the liquid exudation and not upon the fiber of the tree, and I reared many examples after the larvæ had been removed from the trees for over a month, their only food being that provided by the fungous matter collected along with them. I have observed that the first cold weather, not frost, proves fatal to most of the larvæ.

Of parasites I found only a small worm which moved freely about in the interior of the body of the larva. In form this resembles a

nematode, but having had so far no opportunity of submitting it to an authority on the group I can not present any definite information as to its identity.

The following observations regarding the family status of the genus may be of interest to students of the *Nemocera*.

The genus *Mycetobia* presents in the larval stage what, judging from our present very meager knowledge of the family, is a departure from the normal mycetophilid respiratory system in having no lateral abdominal spiracles. In fact the lateral tracheal branches simply fork and have no terminal extension which would seem to indicate the recent possession of abdominal spiracles. This is not, to my mind, incompatible with their position in this family, though there are some writers who may differ from me upon this point,—e. g. Osten Sacken, who considered that the genus does not belong to the *Mycetophilidæ* because of the closed spiracles. In this connection it seems necessary to mention a recent paper dealing in an arbitrary manner with the classification of this group.* In the paper referred to there is a summary of facts deduced from the writings of investigators, principally Brauer, unsupported by any other data in possession of the compiler, by means of which the latter endeavors to outline what he considers to be a natural classification of the families in the group. I have the conviction that a natural classification can only be arrived at by a careful consideration of the characters possessed by all stages taken in conjunction with their mode of life. It is impossible, to my mind, to arrive at a decision as to the importance of certain organs as a means of classification unless we know how the species live, what is the importance of the organs in the habitat, and, finally, to what extent a departure from a certain mode of life may affect one set of organs in comparison with others that seem to be of less fundamental significance. That we may, and do, find species in a family with certain organs functional which in others are vestigial or even absent, is not sufficient reason for the separation of such species into different families, and though the respiratory system is of more importance probably than any other one character, I consider that it is absurd to lay down any rule of classification based upon that one character, which is admittedly variable in most groups of insects, especially in view of the fact that we are unacquainted with probably ninety-five per cent. of the species included, in so far as their larval stages are concerned.

Another, and most reprehensible attitude is that taken by the writer previously referred to when he discounts the evidence brought for-

*The Nemocera not a Natural Group of Diptera. Ann. Ent. Soc. Amer., Vol. 8, 1915, p. 93.

ward by some investigators that *Mycetobia pallipes* has an amphipneustic larva with the statement that although he has not seen the larva he nevertheless believes "that the supposed difference rests upon an error of observation." Thus the careful work of real investigators is ignominiously thrust aside because this writer considers that the facts given, not being in conformity with his ideas and consonant with his unwarranted deductions, are necessarily erroneous. Psychological classifications are not reliable; and while they are at time interesting reading the real factors in classification must first be more fully investigated before any safe ground for deductions as to relationships of families is provided. Notwithstanding the absence of functional abdominal spiracles, we may with an easy mind retain *Mycetobia* in the *Mycetophilidæ*, and it is not improbable that further investigation will prove that it is not the only genus which presents such a departure from what is now considered the normal condition in the family. In fact, the European species *Polylepta leptogaster* Winnertz has been proven by Schmitz to be a departure in a more remarkable manner than is the present species.*

It is not necessary that I should deal with this paper here, but as it appeared three years before the note on classification which has been referred to, and as the genus *Polylepta* occurs in North America it is obvious that mention of it at least is not out of place in the present connection.

Predaceous and Parasitic Orthorrhapha

(Bombyliidæ, Mydaidæ, Asilidæ, Therevidæ, and Cyrtidæ)

It may seem a little presumptuous to formulate a method for the separation of the next seven genera dealt with upon the slender basis afforded by the species available to me, but it is not improbable that the characters which separate these may be found serviceable in the separation of others as yet unknown to me, and a key is given herewith which sets forth the structural differences observed that are considered as probably of generic value. It is essential to a better understanding of generic relations, not only of the genera here dealt with but of all genera in the so-called *Nemocera*, that a knowledge of the early stages be obtained. It is also necessary that entomologists who may be in possession of materials or data, or may later have either, should place whatever they have upon record as an aid to the elucidation of the problems connected with the classification of the group, it

*Biologisch-anatomische Untersuchungen an einer höhlenbewohnenden Mycetophilidenlarve, *Polylepta leptogaster* Winn. Natuurhistorisch Genootschap in Limburg. Jaarboeck, 1912, 4th Note.

being absolutely impossible for any one man, or even for a few men, to cover all the ground in a satisfactory manner.

The key presented herewith is based upon species in the collection of this Laboratory with one exception, and gives a synopsis of the characters which I have used in separating them. There are in the series examples of the following families: *Bombyliidæ*, *Mydaidæ*, *Asilidæ*, and *Therevidæ*. The pupæ of all these families, as far as I am aware, bear a strong resemblance to those of *Tabanidæ*, but the pupæ of the latter differ noticeably, as far as I have seen, in having no long thornlike cephalic processes, the protuberances being short and not heavily chitinized. The use of the cephalic armature by the *Asilidæ* and their allies in digging their way out of the ground necessitates that those organs be strong, as the species often must burrow through rather hard dry soil, while the *Tabanidæ*, being for the most part species which live in water or in moist situations, do not require such powerful organs to assist in their emergence from their pupal habitat. The abdomen in all the species included in the key is armed upon each segment with a median transverse series of thorns, or hairs and thorns in alternation. This feature is somewhat similar to that presented by the pupæ of the *Tabanidæ*, but the apical segment differs considerably in the two groups, while the species of *Tabanus* have usually the transverse thorns or hairs in a double row, the anterior one consisting of shorter and stronger thorns than the posterior one.

The pupæ of the only two species of *Cyrtidæ* that I have seen, one of which is described in the present paper, differ very considerably from those of the group included in the key, and also from the *Tabanidæ*, in having the head and abdomen without thorns or bristles, and the abdominal spiracles reduced in number, there being not more than five pairs.

Key to Pupæ

1. Head with but two thorns, abdominal spiracles conspicuously elevated, thornlike ..... *Psilocephala hæmorrhoidalis* (p. 334).
— Head with more than 2 thorns, abdominal spiracles reniform, not conspicuously elevated 2
2. Dorsal abdominal segments with a transverse series of short flattened thorns on middle of each segment, and alternating long, slender, slightly curled hairs; sometimes the short thorns are bent upward at right angles at bases and apices*..... (*Bombyliidæ*) 3

*In all cases that I have seen these short thorns have the appearance of being attached to the abdomen, rather than of being a part of it as is the case in the other pupæ dealt with here.

— Dorsal abdominal segments without long slender curled hairs, the transverse series consisting of strongly chitinized thorns which alternate in size....8

3. The short stout thorns on abdominal segments 2 to 4 bent upward at right angles at bases and apices; armature of head consisting of a lunate series of 4 strong thorns on upper margin the bases of which are contiguous, and 2 shorter, downwardly directed thorns on middle near lower margin.....*Spogostylum anale* (p. 328).

— The short stout thorns on abdominal segments either bent up at apices only and the armature of head not as above, or if the short thorns are bent up both at bases and apices the head armature consists of 8 thorns....4

4. Upper pair of cephalic thorns slender, widely separated at base...5

— Upper pair of cephalic thorns very stout, contiguous at base..... ..... (*Anthrax*) 7

5. The short abdominal thorns bent upward at right angles at bases and apices.....*Exoprosopa fasciata?* (p. 329).

— The short abdominal thorns not bent up at base, only so at apices 6

6. Lateral pair of cephalic thorns contiguous at base, the lower one without basal protuberance or hairs..... .....*Exoprosopa fascipennis* (p. 330).

— Lateral pair of cephalic thorns rather widely separated at base, the lower one with a short wartlike protuberance at base on under side which has upon it 2 or 3 hairs....*Sparnopolius fulvus* (p. 331).

7. Upper pair of cephalic thorns simple, without a small tooth at base on outer side; viewed laterally the middle one of the 3 caudal thorns on each side is much smaller than the lower one, sometimes indistinguishable.....*Anthrax hypomelas* (p. 334).

— Upper pair of cephalic thorns each with a small tooth on outer side at base; viewed laterally the middle one of the 3 caudal thorns on each side is about as large as the lower one..... .....*Anthrax lateralis* (p. 332).

8. Upper pair of cephalic thorns directed outward and slightly upward; apices of wing sheaths extending beyond apices of sheaths of middle legs.....*Mydas clavatus* (p. 336).

— Upper pair of cephalic thorns directed forward and slightly downward; apices of wing sheaths not extending beyond apices of sheaths of middle legs.....(*Asilidæ*) 9

9. Prothoracic spiracle merely a rugose area, without well-defined reniform portion; abdominal spiracles very large..... .....*Promachus vertebratus* (p. 337).

— Prothoracic spiracles rugose, but with a well-defined reniform area which is distinctly elevated....10

10. Apices of sheaths of fore legs extending very distinctly caudad of apices of wing sheaths.....*Deromyia winthemi* (p. 338).

— Apices of sheaths of fore legs not extending to apices of wing sheaths 11

11. Middle of wing sheath with a small distinctly raised area; apical abdominal segment truncated, the upper pair of thorns directed upward.....*Proctacanthus milberti* (p. 339).

— Middle of wing sheath without raised area; apical abdominal segment not truncated, the upper pair of thorns directed backward and slightly curved downward.....*Asilus notatus* (p. 340).

I have not included any species in the key of which I have not examined specimens, preferring not to use descriptions which I might misinterpret. I have, however, indicated in the text characters which appear to be available for the separation of *Systœchus orcus* from *Exoprosopa fasciata* and *Aphœbantus mus* from *Sparnopolius fulvus*.

Erax lateralis Macquart has been recorded by Titus as predaceous upon *Ligyrus* spp.* Unfortunately the figures and descriptions of the larva and pupa given by him are too vague to permit my discovering their distinctive generic characters.

BOMBYLIIDÆ

Many species of this family have been reared both in North America and in Europe, and the larvæ have been found to be predaceous or parasitic in all cases put upon record. Williston gives a summary of their larval habits†. *Aphœbantus* and *Systœchus* are predaceous on egg-masses of the locust *Caloptenus spretus*. *Anthrax* is recorded as parasitic upon three genera of *Hymenoptera—Megachile*, *Osmia*, and *Odynerus*—and three genera of *Lepidoptera—Mamestra*, *Noctua*, and *Agrotis; Spogostylum* upon four genera of *Hymenoptera—Pelopœus*, *Megachile*, *Cemonus*, and *Osmia*—and two genera of *Coleoptera—Cicindela* and *Calicodoma; Bombylius* upon the hymenopterous genera *Andrena* and *Colletes; Toxophora* upon the hymenopteran *Eumenes;* and *Systropus* on the lepidopteran *Limacodes;* while *Callostoma* is predaceous on the egg-masses of the locust *Caloptenus italicœ*.

Vassiliew, in a short note on the biology of some European species of *Anthrax*, records the occurrence of *morio* Linn. and *velutina* Fall. as secondary parasites of *Masycera sylvatica* Fall., a tachinid parasite of *Dendrolimus pini* Linn.‡

*Some Miscellaneous Results of the Work of the Bureau of Entomology. Bull. 53, Bur. Ent., U. S. Dept. Agr., 1905, p. 15.

†Manual of North American Diptera, p. 213. 1908.

‡Beitrag zur Biologie der Gattung Anthrax Scop. (Fam. Bombyliidae.), Zeitschr. für Wiss. Insektenbiol., Bd. 1, Heft 4, p. 174. 1905.

Spogostylum anale Say

Anthrax anale Say, Jour. Acad. Nat. Sci. Phil., Vol. 3, 1823, p. 45.

Larva.—Length, 12–14 mm. White. Head small and inconspicuous (Pl. LXXXIII, Fig. 1), retracted within the first thoracic segment to the point marked X in figure; mandibles strong, slightly serrated on latero-ventral surfaces, curved downward; dorsal surface of head with 5 strong hairs arranged as in figure. Thoracic and abdominal segments with strongly defined incisions between them; prothoracic spiracle large; abdomen without noticeable spiracles (in preserved examples); apical abdominal segment conspicuously attenuated, produced in the form of a short point; no surface hairs on abdomen or thorax.

Pupa.—Length, 12 mm. Testaceous. Head with the upper armature consisting of 4 strong thorns in a crescentic series, their bases connected, and 2 smaller downwardly directed thorns near ventral surface on median line as shown in Figure 9, Plate LXXXIII; 6 long hairs on head, 4 at bases of upper thorns and 2 at bases of the median pair. Thorax with 4 long hairs, 2 above base of wing-sheath and 2 closely placed ones about midway between them and the dorso-median line in transverse line with them; prothoracic spiracle distinct. First abdominal segment with a transverse series of long closely placed slightly curled hairs anterior to middle from a little distance on each side of median line to a point more than midway to spiracle, the series broadly interrupted in the middle, and this area without the short bristles present in *Anthrax* and *Exoprosopa;* posterior to the spiracle on first segment are about 6 remarkably long hairs directed outward and slightly forward; segments 2 to 4 with the transverse armature consisting of long hairs alternating with short bristles, the apices and bases of the latter bent upward at right angles (Fig. 2); armature of segments 5 to 8 consisting of long hairs, the series except on segment 8 usually with short, straight, alternating bristles; spiracles small but distinct on segments 1 to 7; apical segment with 2 slender slightly curved thorns (Pl. LXXXIII, Figs. 8 and 10); armature of segments posterior to spiracles consisting of very long hairs, that of ventral segments of transverse series of moderately long hairs which are discontinued on middle of segments.

The larvæ and pupæ from which the foregoing descriptions are drawn, are those obtained by Dr. V. E. Shelford near Chicago, and which were used by him as a basis for his paper on the species.* Dr.

*The Life-history of a Bee-fly (*Spogostylum anale* Say) Parasite of the Larva of a Tiger Beetle (*Cicindela scutellaris* Say var. *lecontei* Hald.). Ann. Ent. Soc. Amer., Vol. 6, No. 2, 1913, p. 213.

Shelford kindly permitted me to use his material. The species is ectoparasitic.

The species is represented in the collection here by imagines from the following Illinois localities: Pekin, Quincy, Algonquin, Cedar Lake, Clay City, Grafton, Thebes, and Mt. Carmel. There is also a specimen from St. Louis, Mo. The dates of occurrence are in August with the exception of the example from Mt. Carmel, which is given as having been taken June 10 or 11—a rather unusual date if correct. Dr. Shelford gives a summary of localities for the species in his paper from data obtained from dipterologists.

Exoprosopa fasciata Macquart ?

Exoprosopa fasciata Macquart, Dipt. Exot., Vol. 2, Pt. 1, 1838, p. 51.

Pupa.—Length, 20 mm. Testaceous yellow, thorns and wing sheaths dark brown. Head with 8 strong thorns; upper median pair widely separated at base; lateral view of head as in Figure 6, Plate LXXXIII; lateral pair of thorns slender and elongated; 2 strong hairs at base of each of the upper thorns, one above the base of each of the lower median pair and slightly laterad of them, and one close to suture between head and thorax, slightly above level of lower thorns. Thorax with the usual 4 hairs, a widely placed pair above wing base and another pair closely placed midway between wing base and dorso-median line and distinctly caudad of the posterior one of the former pair; wing sheath with a distinct, bifid, wartlike protuberance close to costal margin near base; apices of middle leg-sheaths projecting distinctly beyond apices of wing sheaths; prothoracic spiracle with well-defined rugose reniform area. Abdominal segments 2 to 6 with the bases and apices of the short thorns of the transverse series turned up at right angles (Pl. LXXXIII, Fig. 3); first segment with a transverse series of long curled hairs which does not extend over the median line and is discontinued about two thirds of the distance to spiracle; posterior to the spiracle is a series of about 8 long hairs which are distinctly shorter than those of the segment above; spiracles of moderate size, margins rugose; apical segment as in Figures 4 and 11.

The pupal exuvium from which the foregoing description was drawn was found in a garden in Urbana by Miss E. Mosher, August, 1914. There is little doubt about the identity of the species, although the imago was not directly associated with the specimen, for the large size and dark-colored wings, coupled with the fact that *fasciata* is the only common species that agrees in these respects occurring at this time here, make it very probable that the identification is correct.

The species is represented in the collection here by imagines from the following Illinois localities: Lake County, Algonquin, Waterman, Milan, Bloomington, Normal, Pekin, Forest City, Havana, Champaign, Urbana, Meredosia, Camp Point, Belleville, Dubois, Grand Tower, Alto Pass, and Metropolis, the dates of collection ranging from July 12 to August 31. The species is a very common one and probably occurs throughout the entire state. There is also in the collection one specimen from New Harmony, Ind., taken September 2, and one from Delaware Co., Pa. I have taken the species at White Heath, Ill., on two species of *Monarda* and on *Helianthus* in August.

The pupa which I have associated with this species bears a striking similarity to that figured by Riley for *Systœchus oreus*, differing however in the dark color of the wing cases and in their being comparatively shorter, not extending to the apex of the second abdominal segment, whereas in *Systœchus oreus* they extend to apex of third. There is also an evident distinction in the structure of the dorsum of the apical segment.

Exoprosopa fascipennis Say

Anthrax fascipennis Say, Keating's Narrative of an Expedition to the Source of St. Peter's River, etc., Appendix, p. 373. 1824.

Pupa (Pl. LXXXI, Fig. 4).—Length, 16 mm. Pale testaceous, slightly shining, thorns on head black-brown. Upper pair of cephalic thorns directed forward and very slightly downward, widely separated at base, parallel; below the level of these thorns on each side, on a raised base, are two stout thorns, the inner one long and directed almost straight forward, the outer much shorter, slightly curved, and directed outward; on each side of median line of lower margin of front is a stout thorn, the bases of the thorns connected (Pl. LXXXI, Fig. 5); in addition to the thorns there are 6 long slender hairs on the head capsule, as shown in the figure, visible from in front, and one on each side close to the suture between head and thorax, located near base of the sheath containing mouth parts. Thorax with a pair of closely placed hairs on disc on each side of median line, and a pair more widely placed, above base of wing; wing sheath with a sharp tubercle about one third from base, near costal margin. First abdominal segment with a transverse series of 5 or 6 short, thick thorns occupying the central portion of anterior margin, and 6 long curved hairs on each side of these in continuation of the transverse series which extends over midway from median line to spiracle; posterior to spiracle are about 7 long hairs; segments 2 to 7 with a regular transverse median series of flattened thorns, as shown in Figures 1 and 2, Plate LXXXI; on segments 2 and

3 there are no alternating slender hairs between the median 6 or 8 thorns and the hairs are rather weak when present; on segment 4 these hairs are not present between the median 4 thorns; on the other segments, 5 to 7, they are present on the whole series; segment 8 has about 6 short stout thorns in the transverse series between which, except in the case of the central pair, there are alternating long hairs; lateral aspect of pupa as shown in Figure 4; apical segment of abdomen with a parallel pair of stout upwardly and backwardly directed thorns which are broad at base and have each a small subbasal tooth.

The pupal exuvium from which the above description was drawn is that of a specimen reared from *Tiphia* sp. collected at Elliott, Ill., April 27, 1906, and which emerged July 17, 1906. There are in the collection of this Laboratory a large number of specimens of exuvia of pupæ that were obtained at Elliott and Mackinaw, Ill., the imagines emerging on various dates between July 17 and August 8. Some which produced imagines of the parasites were collected September 30. This species is a hyperparasite affecting *Tiphia* species which are parasitic upon *Lachnosterna* species.

The species is generally distributed throughout the state, occurring from the beginning of July till the end of September. Imagines are in the laboratory collection from the following Illinois localities: Algonquin, Savanna, Havana, Pekin, Urbana, Champaign, Normal, Albion, Carlinville, Clay City, Bridgewater, Williams Mountain, Herod, Grand Tower, Alto Pass, Teheran, and Metropolis. There is also a specimen from Westville, N. J.

Sparnopolius fulvus Wiedemann

Bombylius fulvus, Wiedemann, Dipt. Exot., 1821, p. 172.
Bombylius l'herminieri Macquart, Dipt. Exot., Vol. 2, Pt. 1, 1841, p. 103.
Bombylius brevirostris Macquart, l. c.
Sparnopolius fulvus (Wiedemann) Loew, Neue Beitr., Vol. 3, 1855, p. 43.

Pupa.—Length 11–12 mm. Yellowish testaceous, slightly shining. Surface smooth. Head with upper pair of thorns widely separated at base; lateral pair separated by about as great a distance as the length of the lower thorn, the base of the latter with a slight tubercle on lower surface upon which there are two hairs (Pl. LXXXIII, Fig. 7); the pair of thorns on median line of lower portion of head of moderate size, directed downward, and rather widely separated basally; the normal 8 cephalic hairs present. Prothoracic spiracle rather small, distinctly elevated, its apex with narrow rugose rim; mesothorax with 3 hairs, 2 above the base of wing sheath and one midway between that

point and median line, slightly caudad of the posterior one of the preceding pair; in front of wing base is a slight gibbosity which has no elevated thornlike points; wing sheath without a raised area on surface; apices of sheaths of mid tarsi extending to base of last joint of hind pair and distinctly beyond apices of wing sheaths; apices of sheaths of fore tarsi extending to apices of wing sheaths. First abdominal segment with about 6 widely placed weak hairs in a transverse row near anterior margin; segments 2 to 8 each with a transverse series of short stout bristles with alternating slender and, in comparison with other species, short hairs, the bristles on all segments turned upward at apices, most distinctly so on segments 3 to 5; spiracles small but very distinct, similar to that of prothorax, present on segments 1 to 7; posterior to the spiracle on each segment there are 3 moderately long hairs; apical segment as in Figure 5, Plate LXXXIII; ventral segments each with a transverse pair of rather long slender hairs on each side near middle, the one farthest from lateral margin about midway between that point and median line, the other midway between it and the lateral margin.

The specimens from which the foregoing description was drawn are those mentioned by Dr. Forbes in his Thirteenth Report* as having been reared from larvæ of *Lachnosterna,* upon which they are ectoparasitic.

Imagines are in the collection here from the following Illinois localities: Effingham, Neoga, Urbana, and Algonquin, the dates of occurrence being in August and September.

In Riley's figure of *Aphœbantus mus* the apices of the wing sheaths do not extend beyond the apex of the second tarsal joint, the wing sheath has a small protuberance about one third from base near the costa, and there are more than 2 hairs on each side of each ventral segment.

Anthrax lateralis Say

Anthrax lateralis Say, Jour. Acad. Nat. Sci. Phil., Vol. 3, 1823, p. 42.

Pupa.—Length, 14 mm. Testaceous yellow, shining. General habitus similar to that of *Exoprosopa fascipennis.* Head with the pair of strong upper thorns contiguous at base, their upper surfaces with a flattened area (Pl. LXXXI, Figs 16, 17, and 21); below these thorns on each side is a slightly swollen area upon which is a single small tubercle; on the median line considerably below the level of the lateral tubercles is a pair of small sharp points, best seen when viewed

*Twenty-fourth Report of the State Entomologist on the Noxious and Beneficial Insects of the State of Illinois, 1908, p. 161.

from the side (Pl. LXXXI, Fig. 16), near the bases of which is a single long hair on each side; on each side near base of the upper pair of large thorns is a single long hair and another above base of each thorn. Thorax and wing sheaths without tubercles; the pair of hairs above wing base present, the discal hair indistinguishable. Abdomen with spiracles very small; first segment with about 6 short, stout brown thorns on median sixth slightly beyond base, and on each side of these but slightly more cephalad a closely placed series of about 20 long, slender curled hairs, reaching about two thirds of the distance from median line to spiracle; posterior to the spiracle are about 6 long hairs; segments 2 to 7 with a transverse median comblike series of stout brown thorns, interspersed with long slender hairs at about every fourth or fifth one (Pl. LXXXI, Figs. 3 and 8); eighth segment with a pair of closely placed thorns on each side of the median line, between each pair of which is a single slender hair (Fig. 19); apex of abdomen with 3 thorns on each side (Fig. 19); post-spiracular hairs 8–9 in number; each ventral segment with 6–8 hairs on each side of median line in a transverse series.

The pupal exuvium from which this description was drawn is that of a specimen that was reared from a larva parasitic in a pupa of a noctuid moth which was obtained at the Devil's Hole near Havana, Ill., June 8, 1905, the parasite emerging July 1, 1905.

Imagines in the laboratory collection are from the following Illinois localities: Algonquin, Savanna, Milo, Urbana, Champaign, Long Lake, and Kappa. There is also a specimen in the collection from Jamesburg, N. J., and one from San Bernardino, Cal. The dates of occurrence range from June 10 to August 11.

No other specimens in the collection bear any records of life history.

Anthrax alternata Say has been reared from an undetermined noctuid larva* by Gillette, and recorded by Riley and Howard. In the same paper *Anthrax hypomelas* Macquart is recorded as having been reared from a pupa of *Agrotis herilis* by Webster, and *A. molitor* Loew from a pupa of a noctuid resembling *Tæniocampa rufula*. Zetterstedt, in 1842, stated that the group to which *lateralis* belongs, deposits eggs upon lepidopterous larvæ. Glover, in the Agricultural Report for 1866, mentions that "an *Anthrax* has been bred from the chrysalis of a moth."†

*Insect Life, Vol. 2, 1890, p. 353.

†Loc cit., p. 354.

Anthrax hypomelas Macquart

Anthrax hypomelas Macquart, Dipt. Exot., Vol. 2, Pt. 1, 1838, p. 76.

Pupa.—Length, 14 mm. Pale testaceous, slightly shining; thorns on head and on abdomen dark brown. Upper pair of cephalic thorns contiguous for two thirds of their length (Pl. LXXXI, Fig. 22), lateral thorn flattened, simple, the pair on median line near lower margin contiguous, a small fine hair on each side of the latter pair, a longer hair on each side of the upper pair of thorns and another above the base of each thorn (Fig. 20). Thorax without protuberances; a pair of small fine hairs above the base of wing cases, and another pair on each side of median line about middle of thorax. Abdomen similar to that of *A. lateralis,* differing only in having apical armature as in Figure 18, the median tooth having more the appearance of a small process on base of upper one than of a separate tooth, or occasionally almost indistinguishable.

As mentioned under the previous species, *hypomelas* has been recorded by Riley and Howard, but the figure given in the paper is not clear enough in detail to permit of its specific characters being recognized although the general habitus is unmistakable.

The specimens of *hypomelas* pupæ that I have seen include one, without label data, obtained from the Ohio Agricultural Experiment Station, Wooster, Ohio, with the statement that it had been reared at Wooster in 1907, and two in this Laboratory.

The pupal exuvia last referred to are those of specimens reared from *Feltia jaculifera* at Urbana, Ill. The larvæ of the moth were obtained June 8, 1901, and the parasites emerged September 14 of that year from the pupæ of the host.

Specimens of the imago are in the collection here from the following localities: Havana, Ill., September 5, 1905; Urbana,, Ill., September 21, 1890 (C. A. Hart); Grand Forks, N. Dak., July and August, 1890, (Miss M. J. Snyder); and Westville, N. J., September 9, 1901.

THEREVIDÆ

Psilocephala hæmorrhoidalis Macquart

Thereva hæmorrhoidalis Macquart, Dipt. Exot., Vol. 2, Pt. 1, 1841, p. 26.

Larva. (Pl. LXXXI, Fig. 10).—Length, 22 mm. White. Head brown, black on posterior margin of dorsal surface. Dorsal sclerite with a long slightly curved hair on each side one third from posterior margin; dorsal and ventral sclerites separated laterally by a rather broad membranous stripe, near the anterior extremity of which is a

very long hair directed downward and curving slightly forward, and about the middle there is a similar hair, as shown in Figure 9. Internally there are 2 strong rods connected with the mandibles, and attached to the posterior margin of the dorsal sclerite is a strong rod, dilated posteriorly, which runs to the posterior margin of the first thoracic segment internally. Thoracic segments each with a long curved hair near the middle on sides, prothoracic respiratory organ short, located close to posterior margin of segment. Abdomen with segments as in Figure 10, the pattern shown being probably caused by the spines of the pupa showing through; surface without hairs except on last segment, where there are 2 pairs, one on the dorsum and the other on the venter; apex bifid (Fig. 10, *a*).

Pupa. (Pl. LXXXI, Figs. 11 and 12).—Length, 9 mm. Yellowish white. Surface of integument of body slightly wrinkled. Head and thorax in lateral aspect as in Figure 15, thorn on wing base remarkably long and slender. Thoracic respiratory organ tubelike, the abdominal spiracles almost identical with it in form, their apices presenting to the eye the appearance of small rounded openings. Apex of abdomen with 2 long curved spines directed slightly upward (Fig. 13).

This species was found by D. K. McMillan, the field assistant of this office for northern Illinois, commonly in truck gardens infested with wireworms, upon which it feeds in the larval stage. I have seen the larvæ occasionally in wheat fields, and the adult is represented in the laboratory collection from the following localities: Algonquin, June to August (Nason); Havana, August 18, 1904 (Hart and Brown); Piper City, July 27, 1888 (Marten); Grand Tower, August 25, 1889 (Hart); Urbana, July 21, 1899 (Hart), and June 14, 1915, on flowers of wild parsnip (Hart and Malloch); Champaign, July 14, 1899 (Hart); McHenry, July 31, 1884 (Webster); Philo, June 3, 1887, from pupa found in sod corn (Hart); West Union, May 24, 1884; Waterman, July 27, 1883 (Webster); Monticello, June 28, 1914 (Hart and Malloch),—all in Illinois; Jamesburg, N. J., July 4, 1893.

The larvæ of this family are recognizable by the peculiar subdivision of the abdominal segments, as shown in the figure (10) herewith, which gives them the appearance of having 20 segments. In some other families there is a similar subdivision, for example in *Mycetophilidæ* (see *Mycetobia*, Pl. LXXX, Fig. 12), but the subdivision is of a different character, the short portion of the segments being appreciably shorter than the anterior portion is in *Psilocephala*. This species and probably allied species are no doubt of considerable eco-

nomic importance as enemies of wireworms, and it seems strange that nothing has been published in America regarding this habit.

In Europe several species have been reared, and all are credited with being predaceous enemies of insects in the larval stage. A fairly complete summary of the European investigations has been given by Lundbeck in "Diptera Danica", Part 2 (1908), p. 137. In this paper mention is made of the fact that occasionally the larvæ of *Therevidæ* may devour their own kind—a fact that comes within the knowledge of the present writer from his experience in rearing *Psilocephala,* the reason for the cannibalism being the lack of other food.

MYDAIDÆ

Mydas clavatus Drury

Musca clavatus Drury, Illustrations of Natural History, Vol. 1, p. 103, 1770.

Pupa (Pl. LXXXII, Fig. 9).—Length, 36 mm. Reddish brown, subopaque. Surface of head and thorax coarsely rugose, that of abdomen rather finely and regularly rugose. Thorns of head rugose to apices, lateral cephalic thorn as in Figure 16. Front of head as in Figure 10; lateral aspect as in Figure 15. Thorax with a bifid humeral tubercle, the one on wing-base with a single flattened thornlike process. First abdominal segment with the thorns (Fig. 21) directed forward and located close to anterior margin, succeeding segments with the thorns rather smaller, directed backward, and located caudad of the transverse median line of the segments, the portion of each segment caudad of the thorns declivitous and honeycombed, the anterior portion irregularly rugose; apical segment with 2 slightly curved processes which are a little upcurved (Fig. 8); spiracles as in Figure 23.

The specimen from which the above description was drawn, was obtained at White Heath, Ill., May 26, 1910, as a larva in a rotten tree-stump, the adult emerged July 18, 1910 (A. G. Vestal). The writer obtained a pupa under a rotten tree-stump at Kinderhook, Ill., in June, 1914. The laboratory collection contains imagines from the following Illinois localities: Urbana, July 4, 1914 (Malloch) and August 3, 1909 (Hart); Champaign, August 13, 1892 (Hucke); Albion, July 12, 1888 (Marten); Havana, July 13, 1897 (Hart and Brown); Alto Pass, August 27, 1889 (Hart); Pinkstaff, July 1, 1911 (Glenn); Monticello, July 2, 1914 (Hart and Malloch); Muncie, July 5, 1914 (Hart and Malloch); and Bloomington, July 26, 1895.

The specimens taken at Muncie were mostly captured on flowers of milkweed, several being taken with the fingers—a proceeding which generally results in the captor's discovering that the insect can pinch

rather severely with the hind femora and tibiæ. So far I have failed to find the larva, no opportunity offering to search for it, but from the fact that many imagines were found on cut-over land where the old tree-stumps remained, upon which the insects often settled, I believe that larvæ must be common in the various localities where I have seen the imagines.

The larva has been recorded as feeding upon the larvæ of insects in old tree-stumps, and the imago has also been recorded as predaceous. I am unable to confirm the last record, as all the specimens taken by both Mr. Hart and myself were upon flowers or at rest upon tree-stumps. It is not impossible that the species is predaceous, but from personal observation and an examinatian of the mouth parts, which differ essentially from those of *Proctacanthus* and allied forms, I infer that if it is predaceous it is rarely so and must be only in cases where the prey is soft-bodied. It is necessary that exact observations be made to determine the facts of the case, negative evidence such as I am in possession of being inconclusive.

ASILIDÆ

Promachus vertebratus Say

Asilus vertebratus Say, Jour. Acad. Nat. Sci. Phil., Vol. 3, 1823, p. 47.

Larva (Pl. LXXXII, Fig. 12).—Length, averaging 40 mm. (preserved specimens). White, head and spiracles brown. Head with 10 long hairs, 5 ventral and 5 dorsal, as shown in Figures 24 and 25; mandibles opposed, long and stout; maxillary palpi of moderate size; antennæ very small. Each thoracic segment with 2 hairs, one on each side on ventral surface; prothoracic respiratory organ located near posterior margin on side; anal respiratory organs (Fig. 13) located in a depression on portion anterior to last segment (8th abdominal segment?), the latter with 8 long hairs, 4 ventral and 4 dorsal (Figs. 11 and 14).

The larva here described is without doubt that of *vertebratus*, although no direct connection has been established between it and the imago. There is in the collection, however, a poorly preserved specimen that agrees in all particulars with the above, which is one of several specimens obtained by J. J. Davis, the others being reared and producing imagines of *vertebratus*. The larva is found not uncommonly in spring where ploughing is being done.

Pupa.—Length, 27 mm. Yellowish brown, head and thorax shining, abdomen subopaque. Head similar to that of *Asilus notatus* (Pl.

LXXXI, Figs. 6 and 7), lateral cephalic thorns as in Figure 4, Plate LXXXII. Thorax differs from that of *notatus* in having near the base of the wing sheath, in longitudinal line with the bifid tubercle at base of posterior leg sheath (Fig. 5), a sharp-pointed tubercle, and midway from base to apex of wing case, on its median line, 2 small wartlike protuberances on a common base. Abdominal spiracles c-shaped, very similar to those of *Mydas clavatus*, the open side directed cephalad; the abdominal armature (Fig. 20) similar to that of *Asilus notatus*, differing noticeably only on the apical two segments, the penultimate segment in *vertebratus* having strong thorns on dorsum as on other segments, while in *notatus* there are only hairs similar to those of the ventral segments; the difference in the apical segments of the two species is shown in Figure 14, Plate LXXXI, and Figure 2, Plate LXXXII.

The pupa from which the above description was drawn resulted from a larva obtained at Havana, Ill., April 24, 1905, and the imago emerged July 24, 1905.

The larva is predaceous, feeding upon the larvæ of *Lachnosterna*, and the species is distributed throughout the entire state, though not very common in most localities.

Deromyia winthemi Wiedemann

Dasypogon winthemi Wiedemann, Dipt. Exot., 1821, p. 223.
Diogmites misellus Loew, Berl. Ent. Zeitschr., 1866, p. 22.
Deromyia winthemi Van der Wulp, Tijdsch. v. Ent., Vol. 25, 1883, p. 93.

Pupa.—Length, 20–25 mm. Brownish yellow, distinctly shining; thorns dark brown. Upper pair of cephalic thorns directed forward and curved slightly downward, distance between them distinctly greater than that between them and upper one of the 3 lateral thorns; lateral thorns as in Figure 16, Plate LXXX, the lower one without basal projection. Prothoracic spiracle reniform apically, distinctly elevated; a distinct wartlike swelling on disc of thorax just above wing base; the pair of thorns in front of wing base on lateral margin of disc of thorax very long, curved backward at their middle (Fig. 14); wing cases without central protuberances, their apices in vertical line with second abdominal spiracle and much proximad of apices of sheaths of fore legs. Abdomen with transverse rugæ except on portion of first segment anterior to the transverse series of thorns, where the rugæ are longitudinal; armature of abdomen rather variable, normally as follows: first segment with a transverse series of stout thorns near anterior margin, which are broadest at middle, stand up-

right, and are slightly bent caudad near apices, several of the thorns being occasionally bifid apically; segments 2 to 7 each with a median transverse series of thorns which alternate in size, the shorter ones being generally stouter and very often bifid on middle portion of series; eighth segment with a much weaker transverse series than the others; posterior to the spiracle on first segment is a series of from 6 to 8 long hairlike bristles; spiracles conspicuous, raised, reniform; armature of ventral segments consisting of a transverse series of weak closely placed hair-like bristles at apical third of each segment except the eighth, which has a series on each side at middle extending from lateral margin halfway to median line; ventral surface without rugæ, apical segment as in Figure 15.

The foregoing description was drawn from specimens found by W. P. Flint, of the State Entomologist's office, in a garden at Springfield, Ill., August 6–8, 1915. One specimen of each sex was reared.

Imagines of this species are in the collection here from Grand Tower, Murphysboro, and St. Francisville, the dates ranging from July 25 to August 2. I took a single specimen on the south campus of the University here August 28, 1915.

Proctacanthus milberti Macquart ?

Proctacanthus milberti Macquart, Dipt. Exot., Vol. 1, Pt. 2, 1838, p. 124.

Pupa.—Length, 25 mm. Pale yellowish brown. Armature of head similar to that of *Promachus vertebratus*, differing in having the pair of anterior, forwardly directed thorns smaller and more widely separated at base and the lateral trifid process without distinct angle on base of lower thorn (Pl. LXXXII, Fig. 6). The pair of thorns at base of posterior leg sheath (Pl. LXXXII, Fig. 7) are longer and more slender than in *vertebratus;* the tubercle on base of wing sheath is absent, and a single wart is present on the swelling on middle of the sheath. First abdominal segment with a transverse series of long slender spines, about 18 in number, which are directed slightly forward, their points slightly recurved, the series occupying two thirds of the length on each side between the median line and the spiracle; between some of the long spines there is sometimes a smaller spine; posterior to the first spiracle are about 7 long hairs (Fig. 22)—3 in *Asilus notatus* and *Promachus vertebratus;* segments 2 to 7 each with a transverse median series of long slender spines alternating with shorter stout thorns which are single, bifid, or paired (Fig. 19); eighth segment with a transverse series of spines which are of irregular sizes and unevenly arranged; apical segment with a long slender upwardly

directed spine on each posterior dorso-lateral angle, and a small wartlike process about midway between the base of that and the ventral line (Figs. 1 and 3).

The specimens from which the above description was drawn are two empty pupa skins obtained by Mr. Hart at Beach, Ill., August 24, 1906. It is not certain that the pupa is that of *milberti*, as the species was not reared, but imagines were obtained at the same time and place, and as this was the only species of such large size that was found I assume that the pupa very probably belongs to it.

The species is very probably predaceous in the larval stage upon larvæ of burrowing insects.

Illinois localities represented by material in laboratory collection: Jonesboro, Beach, Havana, Forest City, Jacksonville, Alto Pass, Grafton, Grand Tower, Dubois, Oakville, Edgewood, Metropolis, Albion, Carbondale, and Litchfield. Dates of occurrence range from August 8 to September 23.

Asilus notatus Wiedemann

Asilus notatus Wiedemann, Auss. Zweifl. Ins., Vol. 1, 1828, p. 451.

Pupa (Pl. LXXXI, Fig. 7).—Length, 12 mm. Brownish yellow, slightly shining. Head distinctly shining, integument without distinct wrinkles; a pair of strong thornlike projections on anterior cephalic surface (Fig. 6) which are rather irregularly longitudinally rugose at base, smooth and highly polished at apices; on each side of the head, almost in vertical line with these thorns and located on the latero-ventral region there is a tridentate process of a similar nature to the thorns (Pl. LXXXII, Fig. 18), the posterior one having a slight scale-like process near its base. Thorax with faint indications of wrinkling on the surface and 3 wartlike projections on each side (as shown in Pl. LXXXI, Fig. 7), the lower one, at base of sheath of posterior leg, having 2 distinct sharp thorns at the apex (Pl. LXXXII, Fig. 17). Abdomen with surface of all segments wrinkled; first segment with 10 long upright brown thorns (Pl. LXXXI, Fig. 7), the apices of which are directed slightly backward, near the anterior margin on dorsum, the distance from the central one to the outer one being about equal to the distance from the latter to the spiracle; posterior to the spiracle are 3 long fine hairs, otherwise the segment is bare; second to sixth segments each with a transverse median row of stout brown thorns alternating large and small in size, extending from median line midway to spiracle on each side, being replaced at this point by a series of long fine hairs which are carried below the level of the spiracles and almost join the ventral series; seventh segment with the dorsal series located nearer to

the posterior margin than on the other segments, the bristles of almost an equal size, otherwise as preceding segments; eighth segment without dorsal thorns, only the long hairs present on lateral region; apical segment as in Figure 14, Plate LXXXI; ventral segments each with a transverse row of long rather irregular hairs near the posterior margin except in the case of the eighth, which has the series on the transverse median line.

This description is taken from a specimen obtained by the writer on the bank of the Sangamon River near White Heath, May, 1915. It was found in rather sandy soil at a depth of about 6 inches. The specimen which emerged is a male. The imagines were remarkably common in the forestry belonging to the University of Illinois, at Urbana, on June 20, 1915. The larva, which is predaceous, was not obtained. The species is common and generally distributed throughout the state, being probably our commonest species of the genus.

CYRTIDÆ

Unfortunately I have of this family but a single pupal exuvium of one species, and that is in rather poor condition. It proves, however, to be quite different structurally from exuvia in the preceding group, having neither strong hairs nor thorns on any part of head, thorax, or abdomen, thus differing markedly from those herein described and from the *Tabanidæ*, the latter having armature on the abdomen very similar to the asilid group.

It is unfortunate that in the case of the only reared specimen available here no record is given of the circumstances under which the pupa was obtained. Species of allied genera have been found to be parasitic in spiders, or to feed upon their eggs. Mr. J. L. King has obtained the larva and pupa of a species of *Pterodontia* in Ohio. The pupa differs from that of *Oncodes* in possessing only 3 pairs of raised abdominal spiracles.

Oncodes costatus Loew

Oncodes costatus Loew, Berl. Ent. Zeitschr., 1869, p. 165.

Pupa.—Length, 5 mm. White, shining. Head small, without discoverable protuberances or hairs (poorly preserved). Thorax with a wartlike protuberance on each side of disc anteriorly, indicating the location of the openings of the prothoracic respiratory organs. Abdomen with a wartlike protuberance on spiracular areas of segments 1 to 4, segment 5 without protuberance, the spiracle distinguishable, remaining segments without distinct spiracle; apex of abdomen blunt, last segment slightly protuberant but without armature of any kind,

as is the entire abdomen except for the spiracular protuberances (Pl. LXXXI, Fig. 23).

A single specimen of the pupal exuvium of this species is in the collection here. It is unfortunately in rather poor condition, being impaled upon the pin which bears the imago. The locality is Urbana, Ill., June 25, 1904 (Hart and Kegley). Additional Illinois localities (for imagines) are as follows: Carbondale, May 30, 1904, jarred from an apple tree at night (Taylor), and Odin, June 2, 1909, a large series on dead twigs of elm, and one without data, June 23, 1909, from same locality (Hart).

There is a considerable difference in the color of some of the specimens, some having the humeri and scutellum yellowish while others have those parts quite dark, almost like disc of thorax. I am not at all certain that we have as many species in North America as the listed names indicate, as color, which has been exclusively used as a specific separation, appears to be quite unreliable.

Phytophagous and other Cyclorrhapha

SYRPHIDÆ

In this paper I describe the larva and puparium of one species of *Syrphidæ* and the puparia of two others. Two of these have been previously described by other writers, but very briefly.

Metcalf has described and figured the early stages of ten species of *Syrphidæ* from Ohio, one of which is not determined specifically*. All of the named species described in his paper occur in Illinois. It is opportune to notice the occurrence in this state of a parasite of *Allograpta obliqua* Say, which did not occur in connection with Metcalf's work on that species in Ohio. This species belongs to the chalcid genus *Bothriothorax*, and is at present undescribed, according to A. A. Girault to whom the species was submitted. Four examples of each sex of the parasite were reared by the writer from a single larva. The parasites completed their metamorphoses within their host, emerging through a single exit-hole in its skin. This does not coincide with Hubbard's observation on the chalcid parasites of *Baccha babista* quoted by Metcalf†, which emerged through a number of holes in the puparium. Metcalf reared the icheumonid *Bassus lætatorius* Fabricius, from *Allograpta obliqua*. The chalcid *Bothriothorax peculiaris* Howard, has been recorded by Smith as a parasite of syrphid puparia.

*Syrphidæ of Ohio, Bull. 1, Ohio Biol. Surv., published as No. 31, Vol. 17, Ohio State Univ. Bull. 1913.

†Loc. cit., p. 51.

Tropidia quadrata Say

Xylota quadrata Say, Am. Entom., Vol. 1, Pl. VIII; Compl. Works, Vol. 1, p. 14.

Puparium (Pl. LXXXIII, Fig. 17).—Length, 9 mm. Testaceous yellow. Entire body opaque, covered with very short closely placed pale hairs. Lower part of the lidlike anterior portion with 8 small blackish thorns, 4 in a semicircle close to the lower extremity, 2 slightly higher placed, about midway between median line and lateral suture, and 2 close to suture, about midway between lower extremity and the median cross-suture; 2 strong thorns on each ventro-lateral margin close to anterior margin of pupa; anterior respiratory organ (Fig. 18) covered with small glossy knoblike swellings. Posterior extremity with 3 thorns close to ventro-lateral margin; posterior respiratory organ as shown in Figure 19, Plate LXXXIII.

The pupal exuvium from which the above description was drawn, is that of a male which bears the number 13549. The puparium was found floating in the water at Flag Lake, near Havana, Ill., August 3, 1895. Several were found on August 3 and 5, but only one imago emerged (August 14). Two specimens, evidently newly pupated, were found by Mr. Hart in a *Sagittaria* belt which had but recently become inundated.

Imagines in the collection here are from the following localities: Algonquin, Chicago, Champaign, and Urbana, the dates ranging from May 25 to July 17. There are also 2 specimens in the collection from Westville, N. J., taken August 16.

The early stages of the members of this genus have not previously been described, and the larval habits are unrecorded.

Brachypalpus frontosus Loew

Brachypalpus frontosus Loew, Berl. Ent. Zeitschr., 1872, p. 83.

Larva (Pl. LXXXIII, Fig. 12).—Length, 17 mm. White, with the prothoracic thorns and setulæ dark brown, anal respiratory organ pale brown. Surface of entire body with closely placed, stout, small, pale hairs. Front view of head and prothorax as in Figure 14; antennæ of moderate size, apices with two circular sensory organs; anterior margin of prothorax with 3–4 transverse rows of blackish thornlike processes which are recurved apically, the upper or posterior one strongest; prothorax with a strong outwardly directed, backwardly curved thorn on each side and a small respiratory organ slightly nearer to median line; each segment with 10 slight carinæ, 4 on dorsum, one on each dorso-lateral angle, one on middle of each lateral surface, and one on each ventro-lateral angle, each carina with a group of hairs at

middle of each segment, the bases of the hairs being generally fused; hairs on remainder of surface shorter than those on carinæ, and occasionally pairs are fused on lateral surfaces; ventral surface with 7 pairs of conspicuous pseudopods, all of which are armed on apices of posterior surfaces with about 4 series of short blackish recurved thorns, the apical row being strongest; apex of abdomen as in Figure 12.

Puparium (Pl. LXXXIII, Fig .13).—Length of body 11 mm., caudal process, 5 mm. Yellowish brown, slightly shining. Surface as in larva except that the hairs are less conspicuous, the carinæ are indistinguishable, and the rugæ are much more numerous, as shown in Figure 13. The head is entirely retracted and the prothoracic thorns and respiratory organs are brought almost to the antero-ventral margin (Fig. 15); the pair of pupal respiratory processes, so conspicuous in *Tropidia quadrata*, are represented by slight callosities of the surface which are barely distinguishable; ventral pseudopods much less conspicuous than in larva; apical process distinctly broader than high.

The material from which the foregoing descriptions were drawn, was obtained near Urbana, Ill., under bark on a rotten tree-stump. The specimens reared are recorded as pupating March 5 and emerging March 19 and 21.

Imagines in the laboratory collection are from the following Illinois localities: Algonquin, Carlinville, and Urbana, the last-mentioned taken on April 20; the others without dates.

The only previous American record of the larval habits that I know of is that by Keen.*

I know of no previous description of the larva; the pupa has been very briefly described by Parker.†

Ceria willistoni Kahl

Ceria willistonii Kahl, Kans. Univ. Quart., Vol. 6, 1897, p. 141.

Puparium (Pl. LXXXIII, Fig. 16).—Length of body 10 mm., apical process 4 mm. Yellowish white, mottled with brown or blackish, opaque. (Anterior portion with respiratory organs missing.) Surface covered with microscopic pale hairs. Dorsum with a median longitudinal series of paired wartlike tubercles extending nearly to apex, 6 pairs in all; apices of tubercles with a few short setulose hairs; dorso-lateral margin with a single longitudinal series of 6 wartlike tubercles, each of which is slightly caudad of the corresponding sub-

*Can. Ent., Vol. 16, 1884, p. 147.

†Proc. Ent. Soc. Wash., Vol. 17, 1915, p. 147.

median one, and is similarly armed at apex; between the submedian and dorso-lateral warts is a longitudinal series of much smaller ones in direct line with the others, and on the upper margin of lateral area is a similar series of small warts, the whole forming a diagonal series on each side of the 6 segments; medio-lateral line with a pair of small warts on middle of each segment, the anterior one of each pair white, with a conspicuous small brown spot ventrad of it, and located almost vertically midway between the warts of the series dorsad of it; on the ventro-lateral line is a single wart on each segment, located in direct vertical line between the pair in medio-lateral series; ventral segments 1 to 4 each with a small slightly raised circular area on each side of the median line, each area being crowned with numerous dark brown setulose hairs; the remaining segments somewhat flattened and slightly fused, without the well-defined circular areas of the anterior 4, though still discernible, and without the setulose hairs; apical 2 segments each with a transverse series of 4 thornlike processes, 2 on the marginal and 2 on the submarginal line; apical process about 7 times as long as thick, shining brown, transversely oval in cross-section.

The pupal exuvium from which the above description was drawn, is that of a male. The pupa was obtained in a wood at Urbana, Ill., May 12, 1888, by Mr. Hart, and the imago emerged 3 days later.

Banks records the species from Falls Church, Va., where he obtained the pupa on oak bark about the middle of March, the imago emerging March 27. He has briefly described the puparium,* and states that the larvæ of *Ceria* are said to feed in flowing sap of trees. No data on the food habits are on file in this Laboratory.

C. willistoni has been given by some authors as a synonym of *C. signifer* Loew. The puparium of *signifer* is briefly described by C. W. Johnson.† It was found by Dr. Skinner near Bala, Pa., on an oak leaf. It is not possible to decide from the description whether it is identical with that here described.

The localities from which *signifer* has been recorded include Mexico, Florida, and Texas; *willistoni* was described from Kansas.

EPHYDRIDÆ

Hydrellia scapularis Loew

Hydrellia scapularis Loew, Mon. N. Amer. Dipt., Vol. 1, 1862, p. 153.

Larva.—Not preserved, the following characters being ascertained from an examination of the puparium. Anterior and posterior mar-

*Ent. News, Vol. 4, 1893, p. 91.

†Proc. Ent. Soc. Wash., Vol. 5, 1903, p. 310.

gins of dorsal segments except the apical 3 with numerous short setulæ which are irregularly arranged; ventral segments with similar setulæ, which are arranged in distinct transverse series which extend well on to the disc of the segments; antepenultimate segment with a large transverse patch of these setulæ on disc (Pl. LXXXIII, Fig. 16).

Puparium (Pl. LXXXIV, Fig. 13).—Length, 4 mm. Yellowish brown. Anterior respiratory organs absent. Segments with similar armature to that of larva. Apical segment armed with 2 sharp processes which pierce the outer membrane of the leaf in which the puparium is enclosed, and connected with these processes, which are evidently the posterior spiracles, are 2 tracheæ which run forward and presumably connect with the pupal envelope, although the point of connection is not discernible in the specimen before me.

The above description was drawn from specimens obtained by Mr. Hart and the writer at Grand Tower in April, 1914. The larvæ were mining the leaves of a species of *Panicum* growing in a small stream, many of the mines being below the water level.

Two specimens of a hymenopterous parasite were reared, both males. One specimen was submitted to Mr. A. B. Gahan, who identified it as *Gyrocampa,* n. sp. He considered it inadvisable to describe a new species from the male only.

Scapularis is generally distributed throughout the state. There is a previous record of the larva mining leaves of *Hordeum* by Webster and Parks.* Several European species of the genus have been recorded as phytophagous, but so far this is the only North American species on record.

DROSOPHILIDÆ

The imagines of many species of *Drosophila* are numerous throughout Illinois during the greater portion of the year, and may be seen in large numbers on the inside of windows of fruit-stores and delicatessen stores, as well as in cafés and restaurants, where they are readily detected, flying over various foods, by their slow and steady flight. The principal food of the larvæ consists of decaying vegetable matter, exuding sap on trees, and fungi. A few species are found mining leaves of cruciferous plants, and several attack injured fruit.

I am unable to indicate characters for distinguishing the larvæ of the family from allied acalypterates because of the paucity of my material. The larvæ vary very considerably within the genus *Drosophila* as at present limited, and the puparia vary even more in structure; in fact there is more difference between the pupæ of certain species of

*Jour. Agr. Research, Vol. 1, 1913, p. 84.

Drosophila than there is between the pupæ of different genera in some other families.

One species that I have reared has a larva that is capable of jumping much as do the larvæ of most *Cecidomyidæ*. One specimen covered a distance of over 5 inches at a single leap. I expect to deal with this and other species of the family in a subsequent paper.

Drosophila (Scaptomyza) adusta Loew

Drosophila adusta Loew, Berl. Ent. Zeitschr., 1862, p. 231.

Puparium (Pl. LXXXIV, Fig. 1).—Length, 1.5 mm. Reddish brown. Cephalic extremity with two long tapering respiratory processes, the trachea of which may be seen traversing the area of the sunken or flattened portion of puparium. Ventral surfaces of abdominal segments with numerous very minute setulæ, arranged in rather irregular transverse series. Caudal projections whitish, rounded apically and with weak apical hairs. Dorsal surface of abdominal segments armed with setulæ similar to those of ventral surface.

The specimen from which the foregoing description was drawn, was obtained from sap exuding from a mulberry tree at Urbana, Ill., July 3, 1915. It was unrecognized in the larval stage, but the pupa was readily separated from the other species before the adult emerged.

Chittenden has recorded this species, as *Scaptomyza adusta,* mining leaves of cabbage, etc.*.

The habits of the species of this group *(Scaptomyza)* are but imperfectly known, but it seems strange that the same species should be in the larval stage both a leaf-miner and a frequenter of sap of the nature in which I found it. I have seen a very large series of *Scaptomyza,* reared by Mr. A. B. Gahan, at College Park, Md., from cruciferous plants, cabbage and turnip, which led me to conclude when I examined them that the species *flavcola* and *graminum* were synonymous, the series presenting all gradations of thoracic coloration from unicolorous ferruginous to ferruginous with a brown central vitta, and from unicolorous grayish to gray with a dark brown central vitta. It is also worthy of note that in the specimens with unicolorous thorax the setulose discal hairs were arranged rather regularly over the entire surface, whereas in those with the vittate thorax the setulæ were arranged in a single longitudinal series along the margins of the central vitta, and the area beyond these was almost or entirely devoid of setulæ. To arrive at a definite decision as to the distinctness of the forms it would be requisite to rear a series from the eggs.

*Bull. 33, n. s., Div. Ent. Dept. Agr., 1902, p. 76.

Drosophila dimidiata Loew

Drosophila dimidiata Loew, Berl. Ent. Zeitschr., 1862, p. 230.

Puparium.—Length, 2 mm. Pale reddish yellow, slightly shining. General habitus similar to that of *Drosophila adusta.* Anterior respiratory organs about three times as long as their diameter, terminating in numerous fine hairs (Pl. LXXXIV, Fig. 5). Surface of abdomen with the usual transverse bands of short setulæ; apex of abdomen with a scalelike projection as shown in Figures 6 and 7, Plate LXXXIV; above the base of the apical pair of respiratory processes is a pair of small tubercles; cephalad of the scalelike process the surface of the abdomen is broken by 2 or 3 narrow but deep depressions.

The exuvia from which the above description was drawn are those of adults reared from larvæ obtained by Mr. Hart and the writer at Havana, Ill., November 16, 1913. The larvæ were found feeding in fungus on the trunk of a fallen decaying tree on the bank of the Illinois River. The imagines emerged November 21, 1913.

This species was originally described from imagines obtained in Illinois by Le Baron. Aldrich in his "Catalogue of North American Diptera", 1905, gives only the original locality. It is one of the commonest species at Urbana, occurring on windows in the Natural History Building, and on fungi on the campus of the University during the summer. Professor Aldrich informs me that he has taken the species at Lafayette, Ind.

AGROMYZIDÆ

The larval habits of the species contained in the genus *Agromyza* are similar in that all those known are phytophagous, but they differ in the point of attack which they select, some mining in leaves, and others in the roots or in the stem. All so far reported are internal feeders, and several are of economic importance, two of the latter class recently discovered being *Agromyza pruinosa* Coquillett—mining the cambium layer of birch—and *A. pruni* Grossenbacher, mining the cambium of *Prunus.* The last-named species I describe in the present paper. It has not been taken in this state, but almost certainly occurs here. As the original description is very brief and not readily accessible to entomologists I take the opportunity of re-describing it from material kindly supplied me by Mr. Grossenbacher, who reared the species.

There are a large number of very closely allied species in the genus *Agromyza,* and much careful work upon the early stages and food habits is necessary before we shall be able to decide just how many dis-

tinct species we have in North America. In this branch of the work there is a splendid opening for original and valuable investigation.

Agromyza pruni Grossenbacher

Agromyza pruni Grossenbacher, Bull. Torrey Bot. Club, Vol. 42, 1915, p. 235.

Larva, full-grown (Pl. LXXXIV, Fig. 8).—Length, 11–13 mm. White, semitransparent, mouth hooks black. Prothoracic segment longer than succeeding one, head parts retracted within prothorax (Pl. LXXXIV, Fig. 9), prothoracic respiratory organs indistinguishable except in one larva which had evidently been near the point of pupating. First abdominal segment longer than the two preceding thoracic segments together and shorter than second abdominal; segments 2 to 5 subequal in length; 6 shorter than 5; 7 and 8 together about equal to 6; integument of thoracic segments with numerous microscopic punctiform marks which are only visible under a very high magnification; abdominal segments with microscopic setulæ at the incisions, on their anterior margins, those on segments 1 to 5 consisting of one or two series which, like those of the apical segments, do not extend entirely round the body; segment 6 with 3 or 4 series, segment 7 with 6 or 7, apical segment with 8–9; anal respiratory organs rather conspicuous, ending in 3 short branches.

Puparium (Pl. LXXXIV, Fig. 10).—Length, 5 mm. Testaceous, slightly shining. Anterior respiratory organs very small. Abdominal segmentation not deep; segments with weak transverse rugæ; anal ventral orifice marked by a black spot; anal respiratory organs small, but slightly protruded.

Imago: male and female.—Black. Head black, anterior portion of frons, the antennæ, and palpi brown. Legs black, fore tibiæ and tarsi and apices of mid and hind tarsi yellowish (alcoholic specimens).

Frons over one third the head-width; orbits differentiated, each about one fourth the width of center stripe; 5 pairs of orbital bristles present, their length decreasing anteriorly; antennæ of moderate size, third joint rounded apically, pilosity short, arista slender, almost bare, the entire length about equal to that of frons; face concave; cheek narrow, about one sixth as high as eye, marginal bristles of moderate strength, not numerous, vibrissa well differentiated; eye nearly twice as high as long; palpi of moderate size. Mesonotum with 4 pairs of dorso-central bristles, the two anterior pairs reduced in size, the foremost pair well in front of suture; the pair of bristles between the posterior pair of dorso-centrals half as long as the latter; disc with numerous short setulæ. Abdomen stout; male hypopygium small, very much

like that of *parvicornis;* female ovipositor very conspicuous, as long as preceding segment of abdomen, of almost equal diameter throughout its length; surface with short hairs (Pl. LXXXIV, Fig. 11). Legs of moderate strength; mid-tibial bristles small. Wings of moderate width; costa to slightly beyond apex of third vein; inner cross-vein below end of first vein; outer cross-vein less than its own length from inner, slightly bent, its upper extremity nearer apex of wing than its lower; last section of fourth vein about 10 times as long as preceding section; last section of fifth about 1½ times as long as preceding section.

Length, 3.5–4 mm.

The life history of this species has been dealt with by its describer in the bulletin cited under the species name in the present paper, it being an elaboration of his report upon the same species in a previous paper.*

The three species of *Agromyza* known to cause medullary spots in wood of trees are *carbonaria* Zetterstedt, a European species; *pruinosa* Coquillett, occurring in the cambium of river birch; and the present species, found in the cambium of *Prunus avium* and *domestica*. In Grossenbacher's first paper above cited he states that *Cratægus* is also attacked, while *Salix* is not. In his last paper he makes mention only of the species of *Prunus*, and gives his agromyzid a name that leads me to infer that he considers it as a Prunus-infesting species exclusively.

I have recorded *Agromyza pruinosa* from Illinois†, and it is very probable that *A. pruni* occurs in suitable localities. Up to the present I have been unable to devote time to a search for the species.

I have drawn the larva and puparium of *Agromyza parvicornis* Loew (Pl. LXXXIV, Figs. 14 and 15) to show the normal reduction in size due to the induration of the larval skin in pupation in *Agromyza*.

The imago of *pruni* will run down to section 16 in my key to the North American species of this genus‡ if the frons is considered as partly reddish, the cross veins being close together. It is readily separated from both of the species in that section by its robust build and the possession of 4 pairs of dorso-central bristles. The species has much the same appearance as *pruinosa*, but differs in venation, etc., while the food plant and larval and pupal characters are quite enough to separate them specifically. The difference in venation will separate it from *aprilina*.

*Medullary spots: a contribution to the life history of some cambium miners. Tech. Bull. 15, N. Y. Agr. Exper, Sta., pp. 47–65. 1910.

†Can. Ent., Vol. 47, 1915, p. 15.

‡Ann. Ent. Soc. Amer., Vol. 6, 1913, p. 271.

Agromyza tiliæ Couden

Agromyza tiliæ Couden, Proc. Ent. Soc. Wash., Vol. 9, 1908, p. 34.

Puparium.—Length, 2.5 mm. Yellowish white, shining. Segments poorly defined but distinguishable; surface without hairs or protuberance except the anterior and anal respiratory organs. Anterior respiratory organs of moderate length (Pl. LXXXIV, Fig. 18), located on dorsum of first segment, separated from each other by less distance than the length of one of the organs. Anal respiratory organs shorter and comparatively stouter than anterior pair (Pl. LXXXIV, Fig. 19); anal orifice distinct, a few fine irregular reticulated lines on dorsum cephalad of the orifice.

The puparium from which the above description is drawn is one of a lot collected by J. J. Davis at Chicago October 6, 1908, the imagines emerging May 24, 1909. The species makes galls on twigs of linden trees. Besides these specimens there are several in the collection here which were reared by Marten several years ago at Urbana. The galls, "at base of leaf petioles of basswood", were obtained September 27, 1891, and the imagines emerged May 2, 1892. Originally figured and described from Missouri, and recorded as making galls on linden. I subsequently recorded the species from Veitch, Va., and doubtfully from Delaware County, Pa.*

Agromyza angulata Loew

Agromyza angulata Loew, Berl. Ent. Zeitschr., 1869, p. 47.

Larva.—Length, 1.75 mm. Pale greenish or whitish. Segments laterally conspicuously swollen, the incisions between them deep, so that viewed from above the whole larva presents a somewhat moniliform appearance; viewed from the side the larva is not so thick as across the dorsum and the segments present a more even surface with little indication of swellings or constrictions. Mouth parts black and of moderate size; armature consisting of 4 hooks, one at apex, a transverse pair slightly caudad of it, followed by another one at the lower posterior angle of the anterior face. Prothoracic respiratory organs very small and inconspicuous (Pl. LXXXIV, Fig. 2). Segments throughout with microscopic wartlike processes, which are rather widely separated on the surfaces of the swollen portions; apex of abdomen as in Figure 3, Plate LXXXIV.

Puparium (Pl. LXXXIV, Fig. 12).—Length, 1.25 mm. Glossy black, with purple or violaceous reflections, especially in the depres-

*Ann. Ent. Soc. Amer., Vol. 6, 1913, p. 327

sions and on the posterior 3 segments. Surface with similar processes to those of the larva, but almost indistinguishable because of the ground-color. Prothoracic respiratory organs very small. Depressions on body very deep, those on dorsum very conspicuous, slightly crescentic in shape. Apex of abdomen similar to that of larva except that in hardening the projecting portions are contracted considerably and are less clearly distinguishable.

Reared from leaves of *Setaria glauca,* the larvæ occurring in the apical 6 inches of the leaf, usually 4 or more in each mine. In company with another species *angulata* was found to be present on vacant lots both in Urbana and Champaign in July and August, 1915, their work showing up readily because of the conspicuous whitening of the tips of the affected leaves. *Angulata* has previously been recorded as attacking timothy grass*, and it will also feed on wheat. A summary of investigations of the habits and life history of this species, with figures of the imago and puparium, are given by Webster and Parks.†

Descriptions of New Illinois Diptera

In the course of the year it frequently happens that specimens are taken in general collections, or in connection with other work, which belong to undescribed species. Often these species are of economic importance, and usually they are small forms which are readily overlooked in the field. It is considered necessary in the interests of students of the represented order to place the occurrence of such species upon record; to give adequate descriptions of them; and to indicate their relationships with already described species. Isolated descriptions of new species unless very full are often useless for the purpose of identification because of their inadequate nature or the omission of the essential characters by means of which the species of the genus are separated. Many species have been described by writers who were unacquainted with congeneric species, and because of this ignorance they either did not compare their so-called new species with those already described, or they compared it with some species to which it bore but a faint resemblance. The present writer in all cases compares the new species he describes with the forms most closely related, not because he presumes to set an example but because he considers it his duty to do so.

*Malloch.—A Revision of the species in Agromyza Fallén, and Cerodontha Rondani, Ann. Ent. Soc. Amer., Vol. 6, No. 3, 1913, p. 304.

†The Serpentine Leaf-miner, Jour. Agr. Research, Vol. 1, No. 1, Oct. 10, 1913, pp. 83–84.

PHORIDÆ

Platyphora flavofemorata, n. sp.

Male.—Black. Head black, frons highly polished; antennæ fulvous, third joint brown at apex, arista black; palpi fulvous. Thorax glossy black, upper portion of pleuræ, especially posteriorly, brownish; scutellum dull black, the surface shagreened. Abdomen black, distinctly shining throughout, surface with very faint indications of pruinescence. Legs yellow, mid and hind coxæ infuscated at bases; all tibiæ infuscated, the depth of the infuscation increasing from near base to apices; tarsi fuscous. Wings clear, thick veins fuscous. Halteres yellow, apices of stems and the knobs black.

Frons about 1.5 as wide as its length at center, the length slightly less at eye margin than at center, surface with numerous short decumbent hairs, those at vertex slightly longer than those on disc; distance between the posterior ocelli about twice that between either of these and the median one; basal antennal joint rather elongate; third joint about 1.5 as long as broad, rounded at apex; arista subapical, bare, very slender, basal joint very short, slightly swollen; cheeks with 4–5 forwardly and slightly downwardly directed bristles; palpi very small, armed with several stout apical setulæ. Mesonotum broader than long, disc with short hairs and without dorso-central macrochætæ, scutellum about twice as broad as its length at center, margin with a number of decumbent setulose hairs which lie along the edge and give it the appearance of having a rim; disc distinctly shagreened. Abdomen with second segment longer than either of the 3 following segments, 6th longer than 4+5, its lateral surfaces with short hairs; surfaces of abdominal segments minutely shagreened; hypopygium small, surface of dorsal plate shagreened. Legs stout; fore coxæ stout, over two thirds as long as fore femora, their anterior surfaces with setulose hairs which become longer and stronger towards apices of coxæ; fore tibia about two thirds as long as femur, and distinctly longer than basal joint of tarsi (17:10); fore tarsi dilated, especially the basal joint, which is distinctly wider at apex than is the tibia; second tarsal joint appreciably longer than third; mid tibiæ with 2–3 apical setulæ, hind tibiæ with short decumbent setulæ on ventral surfaces, so arranged that they appear like irregular longitudinal rugæ; apices with 2–3 short setulæ and one longer bristle; mid and hind tarsi slender, basal joint of each with a few short downwardly directed setulæ on ventral surfaces. Costa extending to middle of wing; third vein swollen, thicker than costal vein excepting apical part of latter, setulose throughout; second vein distinct, setulose; first vein swollen at apex, extending be-

yond base of second; costal setulæ about equal to diameter of costal vein; veins 4 and 5 very distinctly divergent at apices; greatest distance from vein 7 to margin of wing equal to greatest distance from vein 4 to margin.

Female.—Reddish yellow. Eyes black; frons with a slight pearl-aceous iridescence, antennæ and palpi concolorous with head. Thorax similar in color to upper part of head. Abdomen dorsally darker than thorax, becoming dark brown or fuscous at apex, the iridescence very distinct, especially at base; ventral surface opaque black except at extreme base. Legs reddish yellow, the short setulose hairs on tibiæ and tarsi giving them a slight fuscous color.

Ocelli indistinguishable; width of frons less than twice its length at center, anterior outline convex; eyes very small, each about one tenth the width of frons seen from above; surface of frons with sparse microscopic hairs; antennæ smaller than in the male, shape similar; arista with very slight pale pubescence; palpi almost as large as third antennal joint, with apical setulæ as in male; cheek with 2 distinct groups of setulæ, one extending from middle to eye margin and consisting of 3 strong setulæ and several weak hairs, the other located on mouth margin and consisting of 3 strong setulæ. Mesothorax slightly over 1.5 as broad as long; disc with very weak setulæ, lateral margins more strongly setulose; posterior outline slightly emarginate; appearance of dorsum as in Figure 17, Plate LXXXIV. Abdomen with 6 distinct segments, undifferentiated from thorax except by the transverse suture, its dorsal level and lateral margins similar to those of thorax; fourth segment slightly elongated, its posterior margin broadly and slightly concave; surfaces of all segments with weak setulæ. Legs rather short and stout; fore tarsi short and distinctly dilated, basal joint as long as next two together and less than half as long as tibia; armature of legs as in male except that the mid tibiæ have a long apical spur. Wings and halteres absent.

Length: male, 1.7 mm.; female, 1 mm.

Type locality, White Heath, Ill., August 22, 1915—a pair taken *in copula* on a sandy bank along the Illinois Central Railroad between White Heath and the Sangamon River by the writer.

The male of this species bears a strong resemblance to *coloradensis* Brues*, differing noticeably however in wing venation, which in *flavo-femorata* is similar to that of *curynota*, which Brues described at the same time. In separating the males of the three North American species the following key will be found useful.

*Psyche, Vol. 21, 1914, p. 79.

1. Veins 4 and 5 almost parallel apically.....*coloradensis.*
— Veins 4 and 5 very distinctly divergent apically.....2
2. Legs and antennæ black; scutellum polished; basal joint of fore tarsi almost as long as fore tibiæ.....*curynota.*
— Legs and antennæ yellowish, more or less infuscated apically; scutellum subopaque, shagreened, basal joint of fore tarsi not two thirds as long as fore tibiæ.....*flavofemorata.*

The genus *Platyphora* was described by Verrall in 1877 with the genotype *lubbocki* Verrall, a myrmecophilous species found in Britain*. Nothing was known of the female of the species for a number of years. In 1890 Meinert described the genus *Ænigmatias*† with the genotype *blattoides* Meinert. Mik suggested in 1898‡ that *Ænigmatias* was the female of *Platyphora*. The most definite statement concerning the relations of the genera is that published by Donisthorpe.§ In this paper it is stated definitely that the genera are synonymous, *Platyphora* being simply the winged male and *Ænigmatias* the apterous female of the same genus. This decision was arrived at from data obtained in connection with observations made on ants' nests in which the species of *Platyphora* occur. I am not aware of any copulating record having been made prior to that in the present paper, the decision as to the specific identity of the European species resting upon the fact that only males of *Platyphora* and only females of *Ænigmatias* were obtainable, and that both occurred in the immature stages in the same nests. The record now published confirms the previous one by Donisthorpe, if such confirmation were required.

Coquillett described as a male a female discovered in Arizona.|| This species, *schwarzi* Coquillett, is very similar to *flavofemorata*, and a comparison of the foregoing description with Coquillett's type will be necessary to discover specific differences, although his description seems to indicate that the two are distinct. It is pertinent to indicate here that the females of neither of the species described by Brues are known.

In the case of *flavofemorata* the species was found on a sandy bank where there were numerous ants' nests. The male was running about fairly rapidly, and it was only after I had inverted a cyanide bottle over it that I discovered the attached female. The latter was carried apparently curled forward under the abdomen of the male and was

*Jour. Linn. Soc. Lond., Zool., Vol. 13, 1877, p. 259.
†Entom. Meddel., Vol. 2, 1890, p. 213.
‡Wien Ent. Zeit., Vol. 17, 1898, p. 204.
§Ent. Rec., Vol. 26, 1914, p. 276.
||Can. Ent., Vol. 35, 1903, p. 21.

quite invisible from above on account of the rather large wings of the male, which were folded closely over the abdomen. It is quite possible that it is by this means that the females find their way from one nest to another, as they are themselves not well adapted to do so.

Coquillett's species is recorded as occurring in a situation where no ants' nests were within easy reach.

ANTHOMYIDÆ

Pogonomyia flavinervis, n. sp.

Male.—Glossy black. Frontal and facial orbits slightly brownish, covered with dense silvery pilosity. Thorax with slight, but distinct, grayish pruinescence, which when viewed from in front gives the disc the appearance of being trivittate anteriorly. Abdomen when viewed from behind distinctly gray pruinescent on sides, leaving only a rather narrow dorso-central black line which is more or less interrupted at apex of each segment. Legs black. Wings slightly tinged with yellow, all veins yellow, costa with black setulose hairs. Calyptræ whitish, margins yellowish. Halteres brown, knobs dark brown.

Eyes distinctly separated, orbits each about as wide as central stripe at narrowest part of frons; frons at narrowest part as wide as distance between outer margins of the posterior ocelli; the strong pair of vertical macrochætæ much more conspicuous than the postocular bristles; arista short-haired; head otherwise similar to that of *alpicola*. Thorax with the macrochætæ and hairs as in *alpicola* but much weaker. Abdomen rather narrow and distinctly tapering apically, the macrochætæ and hairs much less conspicuous than in *alpicola*. Legs with the armature much as in *alpicola;* mid femora with the antero-ventral surface armed with a series of 8–9 bristles, which begins before middle and extends to apex, the longest bristle being slightly beyond the middle of the series; postero-ventral surface with a series of 8–9 longer and more hairlike bristles extending from base to a point about one third from apex, the bristles increasing in length from base to apex of series; hind femora with the series of bristles on antero-ventral surfaces much less numerous than in *alpicola;* postero-ventral surface with a single long slender bristle about one third from apex (two smaller and weaker ones in *alpicola*); hind tibiæ with armature like that of *alpicola* except that the bristles are distinctly weaker. Wing venation similar to that of *alpicola*.

Female.—Agrees in color with the male except that the abdomen is almost entirely glossy black.

Eyes separated by slightly less than one third the head-width, orbits each about half as wide as central stripe at its narrowest point; decussate frontal bristles slender. Abdomen much broader than in male. Legs stouter than in male; mid femora with a stout bristle about one fourth from base on the antero-ventral surface which is appreciably shorter than the diameter of the femur (in *alpicola* this bristle is more slender and much longer than the diameter of the femur). Third and fourth wing-veins slightly convergent apically.

Length, 5.5–7 mm.

Type locality, Algonquin (Nason).

The type series consists of one male and three females, two bearing Algonquin labels (one with the date May 24, 1895), and two labeled N. Ill., one of the latter also bearing Stein's label "*Pogonomyia* n. sp.", and presumably the species referred to by him in Berliner Entomologische Zeitschrift*. Subsequently Stein referred to the species a specimen from Wisconsin, but as he had only seen females he did not describe the species.

The foregoing description should serve to separate *alpicola* Rondani, and *flavinervis*. I have not seen *aterrima* Van der Wulp, which was described from Mexico, but it must be very similar to *alpicola* if not identical with it. I have both sexes of *alpicola* from Moscow, Idaho, May 22, 1913 (J. M. Aldrich).

GEOMYZIDÆ

Aphaniosoma quadrivittatum, n. sp.

Female.—Opaque yellow. Head yellow with the exception of a small spot surrounding the ocelli and a small area round the connection between the head and thorax, which are black; eyes iridescent green in life. Mesonotum with four blackish gray vittæ, the center pair indistinctly connected with a similarly colored spot on center of anterior margin at connection of head and thorax, lateral pair discontinued at humeri, posteriorly all four vittæ being discontinued slightly beyond middle of disc, the lateral pair slightly exceeding the median pair in length; lower portion of sternopleura slightly darkened; postnotum blackened on lower half. Abdomen pale yellow, each segment with a conspicuous blackish brown cross-band on basal portion which is broad on median line and narrows towards each lateral margin. Legs yellow. Wings clear, veins yellow. Halteres yellow. Bristles on head and thorax black, surface hairs yellow.

*Vol. 42, 1897, p. 170.

Head slightly higher than long; face concave in center; upper half of back of head concave; post-vertical bristles very weak, cruciate; frons in profile slightly buccate, viewed from above nearly one half the width of head, slightly narrowed anteriorly; orbit not differentiated from center stripe; two distinct orbital bristles present on each side which are slightly reclinate and of moderate size; anterior to the lower one is a short setula; ocellar bristles forwardly directed, divergent; surface of center stripe with numerous short setulose hairs; antennæ rather small, third joint rounded, arista almost as long as frons, bare; cheeks with numerous rather distinct hairs and 2–3 stronger bristles along mouth margin anteriorly; cheek at middle half as high as eye, the latter slightly longer than high. Mesonotum with 2 pairs of widely separated dorso-central bristles, the anterior pair much weaker than the posterior and preceded by a closely placed series of short setulæ which extend along the inner margin of the lateral vittæ almost to anterior margin of disc; acrostichals two-rowed anteriorly, irregularly four-rowed posteriorly; no bristles between posterior dorso-centrals; scutellum slightly flattened on disc, 4 subequal marginal bristles present, the posterior pair located on margin very close to base. Abdomen slightly elongated, pointed at apex. Legs rather slender; tibiæ without preapical bristle. Wings narrow, auxiliary vein complete but indistinct; costa unbroken, first division one fifth as long as second; second vein distinctly arcuate, the cell between it and third vein conspicuously narrowed apically; inner cross-vein about as far beyond apex of first as it is in front of outer cross-vein; outer cross-vein short, not much longer than inner; last section of fourth vein four times as long as penultimate; last section of fifth, one and a half times as long as penultimate.

Length, 2 mm.

Type locality, Urbana, Ill., June 19 to July 9, 1915; on window in Natural History Building, University of Illinois (J. R. Malloch).

The range of variation in color in this species includes forms in which the back of the head is entirely gray, and the dorsum of thorax and abdomen almost entirely blackish gray.

The genus *Aphaniosoma* was described by Becker in 1903*, who distinguished it from *Chyromyia* by the concave occiput, the latter genus having the occiput convex. The characters of the two genera are very similar, but the shape of the head should readily separate them. The Egyptian species, *approximatum* Becker, differs from the above species in having the disc of the mesonotum opaque gray dusted and the pleuræ with gray spots. It is also considerably smaller—.5–.75 mm.

*Aegyptische Dipteren. Mitt. Zool. Mus. Berlin, II Bd., 3 Hft.

AGROMYZIDÆ

Agromyza aprilina, n. sp.

Female.—Glossy black. Frons opaque black, orbits and ocellar triangle glossy; lunula yellowish; face and cheeks opaque, slightly dusted with grayish pruinescence; antennæ, palpi, and proboscis black. Thorax highly polished without trace of pruinescence; scutellum as disc of mesonotum. Abdomen as thorax, with a slight metallic blue sheen towards apex. Legs entirely black. Squamæ and fringes whitish. Halteres yellow, knobs white.

Head in profile as in Figure 4, Plate LXXXIV, frons over one third the head-width, parallel-sided, orbits narrow, each about one fifth as wide as center stripe, five moderately strong orbital bristles present, which decrease slightly in strength towards anterior margin, orbits otherwise bare; frontal triangle distinct, rather broad and short, not extending midway to anterior margin; antennæ of average size, third joint distinctly, but not greatly, longer than broad; arista swollen at base, bare, its length exceeding that of anterior width of frons by about one fourth; face and cheeks as shown in figure of profile. Mesonotum with 4 pairs of dorso-central bristles, which decrease in size anteriorly, the foremost pair being but little stronger than the strong discal hairs of which there are about 6 irregular rows between the anterior dorso-centrals; the pair of bristles between the posterior pair of dorso-centrals distinct. Abdomen elongate, discal hairs numerous and rather strong; ovipositor stout and of moderate length. Legs normal in length and in form; mid tibiæ with the posterior pair of bristles distinct. Costa extending slightly beyond third vein; outer cross-vein slightly beyond middle of wing and a little more than its own length from inner; inner cross-vein beyond end of first vein and two fifths from apex of discal cell; last section of fourth vein four times as long as penultimate section; last section of fifth five sixths as long as penultimate; auxiliary vein complete; sixth vein extending nearly to wing margin.

Male.—Agrees with the female in color.

Differs from the female in the case of one specimen in having the outer cross-vein at one seventh of the distance from inner cross-vein to wing margin.

Length: female, 3–3.5 mm.; male, 2.5 mm.

Type locality, Cottonwood grove, Urbana, Ill., April 16–20, 1915 (J. R. Malloch).

In the key to the species of *Agromyza* in my paper in the Annals of the Entomological Society of America this species will run down

to caption 15. Including *subnigripes* (=*nigripes* Schiner *nec* Meigen) there are four species occurring in North America that fall here; they may be separated thus:

a. Squamæ gray, fringes brown ..... *subnigripes* Malloch.
— Squamæ and fringes whitish ..... aa
aa. Cross veins separated by about the length of outer cross-vein ..... *aprilina*, n. sp.
— Cross veins separated by about twice the length of outer cross-vein ..... aaa
aaa. Arista almost bare; occiput not projecting on upper half ..... *abbreviata* Malloch.
— Arista distinctly pubescent; occiput projecting on upper half ..... *kincaidi* Malloch.

CHLOROPIDÆ

Gaurax Loew

I recently described two new species of the genus *Gaurax* and published a synoptic key to the North American species*. Since sending that paper in for publication I have found three species which are evidently undescribed, and in presenting descriptions of these I feel that it becomes necessary to publish an enlarged synopsis of the species so that students may the more readily recognize the new forms.

I have not found any of the early stages of the species; most of the imagines occurring on tree-trunks and limbs. Several examples of *dorsalis* Loew were taken on windows of the basement in the Natural History Building of the University of Illinois.

In the case of the specimens of *montanus* Coquillett which I took here the apices of the hind femora are slightly brownish, a character possessed by the type also, though omitted in the original description.

Key to Species.

1. Wings not entirely hyaline, either with a black spot at apex of second vein, or with a distinct dark mark or infuscation on disc 2
— Wings entirely hyaline 7
2. Wings with a small black spot at apex of second vein (Toronto, Can.) ..... *pscudostigma* Johnson.
— Wings with a much greater portion blackened 3
3. Thorax and scutellum entirely yellow; a large black mark occupying the area of the wings from middle of second vein between costa and third vein and a small portion of the apex of the cell posterior to third (Ill.) ..... *flavidulus*, n. sp.

*Proc. Ent. Soc. Wash., Vol. 17, 1915, p. 159.

— Thorax with at least black discal marks; wings marked otherwise than as above 4
4. Thorax and scutellum black 5
— Ground color of thorax yellow, disc with black marks, scutellum yellow 6
5. Setulose hairs on frons and cheeks black; wings with very distinct infuscation, which extends to base and is most distinct in cell bounded by first vein and costa; legs entirely yellow (Ill.) ..... *pallidipes*, n. sp.
— Setulose hairs on frons and cheeks yellow; wings with rather indistinct infuscation, which does not extend to base; legs yellow, hind femora and tibiæ largely black (Ill.) ..... *fumipennis* Malloch.
6. Sides of mesonotum near anterior angles with a white spot (Ill.) ..... *splendidus* Malloch.
— Sides of mesonotum without a white spot (Mass.) ..... *obscuripennis* Johnson.
7. Thorax and scutellum glossy black; apical half of hind femora black, the remainder of legs yellow (La.) ..... *pilosulus* Becker.
— Either disc of mesonotum or the scutellum yellow; legs not as above 8
8. Halteres yellow 9
— Halteres black 11
9. Scutellum black, disc of mesonotum yellow, with a posteriorly tridentate black mark which covers almost the entire disc (Pa., Ill., N. H.) ..... *dorsalis* Loew.
— Scutellum yellow, with brownish marks upon the disc 10
10. Disc of mesonotum with 3 confluent black vittæ, forming a large discal mark, rarely narrowly separated; scutellum with a basal black mark on each side (N. H.) ..... *ephippium* Zetterstedt.
— Disc of mesonotum with 3 black spots, the rudiments of the normal vittæ, beyond middle; scutellum with a large brownish mark on disc (Ill.) ..... *interruptus*, n. sp.
11. Legs entirely yellow or with only a faint brownish mark at apices of hind femora (N. H., Vt., Ill.) ..... *montanus* Coquillett.
— Legs with distinct, deep black marks 12
12. Thorax glossy black, lower half of pleuræ and the scutellum yellow (Ill.) ..... *apicalis* Malloch.
Thorax and scutellum yellow, disc of the former with black marks (Pa.) ..... *festivus* Loew.

Gaurax flavidulus, n. sp.

Male.—Yellow, subopaque. Head yellow, ocellar region, inner upper mouth-margin, and back of head black. Thorax yellow, a black central spot on pleuræ and a similarly colored transverse one on middle of postnotum. Abdomen yellow, infuscated on sides of first seg-

ment and entire dorsum of other segments; venter yellowish. Legs yellow, mid and hind tibiæ with a brownish black spotlike mark on dorsal surfaces near base. Wings with a large black mark covering the entire area anterior to third vein from middle of second to apex of third and extending slightly posterior to third near its apex; veins black. Halteres yellow. Setulose hairs on head and thorax black, the weak hairs pale yellow.

Frons over one third the head-width, triangle poorly defined; antennæ small, third joint rounded apically, slightly pilose; arista short-haired; cheek linear; eyes sparsely haired. Surface of mesonotum with weak hairs; apical pair of scutellar bristles distinctly stronger than basal. Abdomen rather slender; hypopygium of moderate size, recurved. Legs normal. Third costal division of wing about three fourths as long as second; veins 3 and 4 parallel, the latter ending in wing tip.

Length, 1 mm.

Type locality, Urbana, Ill., July 4, 1915, at rest on cypress limb (J. R. Malloch).

Differs from any described species of the genus in the wing markings.

GAURAX PALLIDIPES, n. sp.

Male.—Black, shining. Head yellowish brown; frons opaque black-brown, triangle glossy black; antennæ brownish; arista fuscous; palpi dusky yellow; back of head black. Thorax and abdomen shining black, the latter slightly yellowish at base. Legs entirely yellow. Wings with a very distinct infuscation on anterior basal half, which fades out before apex of third vein; veins black. Halteres yellow, knob black. Hairs and bristles on head black; bristles on thorax yellow; hairs on thorax and abdomen white.

Head short and broad; frons one half the width of head, triangle well defined and very large, filling almost the entire frons; lateral and vertical setulæ strong; antennæ large, third joint very hairy; arista slender, short-haired; marginal hairs on cheek strong; eyes very distinctly haired. Mesonotum rather densely covered with long white hairs; scutellum with similar hairs and 4 marginal bristles, the apical pair strongest. Abdomen short and broad. Legs of moderate strength. Third costal division of wing two thirds as long as second; veins 3 and 4 parallel, the latter ending in wing tip.

Length, 1.5 mm.

Type locality, Urbana, Ill., July 4, 1915, at rest on cypress limb (J. R. Malloch).

Differs from *fumipennis* Malloch in having the legs entirely yellow and the infuscation of the wings carried to the base.

GAURAX INTERRUPTUS, n. sp.

Female.—Ochreous yellow, slightly shining. Head yellow, ocellar region, inner upper mouth-margin, and back of head black, arista brownish. Mesonotum with the three vittæ faintly indicated anteriorly, black on posterior third from transverse median line of disc midway to posterior margin; pleuræ with a large glossy black central spot and the upper margin narrowly black; scutellum brownish black except the margin; postnotum yellow above, black below. Abdomen black dorsally, segments paler on anterior margins, venter yellow. Legs yellow. Wings hyaline, veins grayish. Halteres yellow, knobs white. Bristles on head and thorax black, hairs yellowish.

Frons opaque, over one third the width of head, surface with numerous setulose hairs, those on vertex, lateral margins, and a pair on center of anterior margin strong; antennæ rather small, arista short-haired; eyes sparsely haired; triangle poorly defined. Mesonotum with less noticeable surface hairs than in most species of the genus; scutellum with short discal hairs and 4 marginal bristles, the apical pair strong. Abdomen and legs normal. Third costal division of wing about four fifths as long as second; veins 3 and 4 subparallel, the latter ending in wing tip.

Length, 1 mm.

Type locality, Urbana, Ill., July 5, 1915, at rest on cypress tree trunk (J. R. Malloch).

This species is separable from *ephippium* by the interrupted thoracic vittæ, and the discal spot on scutellum.

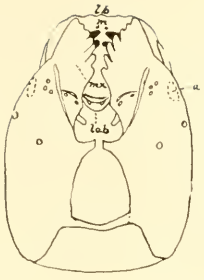
Urbana, Illinois, December 3, 1915.

Plate LXXX

Larval and Pupal Details of Sciara, Mycetobia, and Deromyia

Fig. 1. *Sciara* sp., larva, ventral view of head: *a*, antenna; *lab*, labium; *mx*, maxillæ; *lb*, labrum; *m*, mandible.
Fig. 2. The same, abdominal trachea and spiracle of larva.
Fig. 3. The same, prothoracic trachea and spiracle of larva.
Fig. 4. The same, latero-ventral view of pupa.
Fig. 5. *Mycetobia divergens*, prothoracic spiracle of larva.
Fig. 6. The same, portion of head and prothorax showing trachea and spiracle of larva.
Fig. 7. *Mycetobia divergens*, lateral view of pupa.
Fig. 8. *Sciara* sp., mandible of larva.
Fig. 9. *Mycetobia divergens*, dorsal view of apical segments of pupa.
Fig. 10. *Sciara* sp., clypeus and hypopharynx of larva.
Fig. 11. *Mycetobia divergens*, mandible of larva.
Fig. 12. The same, dorsal view of larva.
Fig. 13. The same, labial plate of larva.
Fig. 14. *Deromyia winthemi*, thorns at base of wing of pupa.
Fig. 15. The same, lateral view of eighth and ninth segments of abdomen of pupa.
Fig. 16. The same, side view of lateral cephalic thorns of pupa.

Plate LXXX



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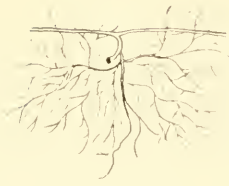

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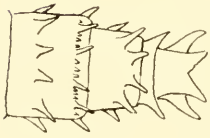

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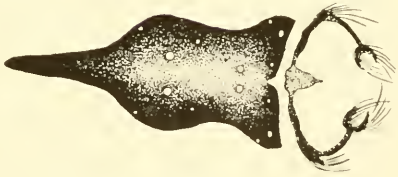

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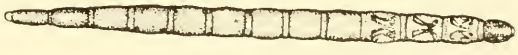

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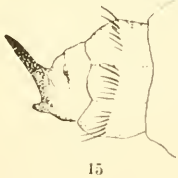

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Plate LXXXI

Larval and Pupal Details of Bombyliidæ, Asilidæ, Therevidæ, and Cyrtidæ

Fig. 1. *Exoprosopa fascipennis*, pupal abdominal dorsal bristles, dorsal view.
Fig. 2. The same, lateral view.
Fig. 3. *Anthrax lateralis*, pupal abdominal dorsal bristles, lateral view.
Fig. 4. *Exoprosopa fascipennis*, lateral view of pupa.
Fig. 5. The same, front view of head of pupa.
Fig. 6. *Asilus notatus*, lateral view of head and thorax of pupa.
Fig. 7. The same, dorsal view of pupa.
Fig. 8. *Anthrax lateralis*, pupal abdominal dorsal bristles, dorsal view.
Fig. 9. *Psilocephala hæmorrhoidalis*, larval head, lateral view: *a*, antenna; *m*, mandible; *pr*, posterior rods.
Fig. 10. The same, lateral view of larva: *sp*, prothoracic spiracle; *1–6*, abdominal segments one to six; *a*, dorsal view of apex of abdomen.
Fig. 11. *Psilocephala hæmorrhoidalis*, ventral view of pupa.
Fig. 12. The same, dorsal view.
Fig. 13. The same, lateral view of apex of abdomen of pupa.
Fig. 14. *Asilus notatus*, lateral view of apex of abdomen of pupa.
Fig. 15. *Psilocephala hæmorrhoidalis*, lateral view of head and thorax of pupa.
Fig. 16. *Anthrax lateralis*, lateral view of head of pupa.
Fig. 17. The same, front view of head of pupa.
Fig. 18. *Anthrax hypomelas*, lateral view of apical segments of abdomen of pupa.
Fig. 19. *Anthrax lateralis*, same as above.
Fig. 20. *Anthrax hypomelas*, lateral view of head of pupa.
Fig. 21. *Anthrax lateralis*, dorsal view of head of pupa.
Fig. 22. *Anthrax hypomelas*, same as above.
Fig. 23. *Oncodes costatus*, lateral view of abdomen of pupa.

Plate LXXXI

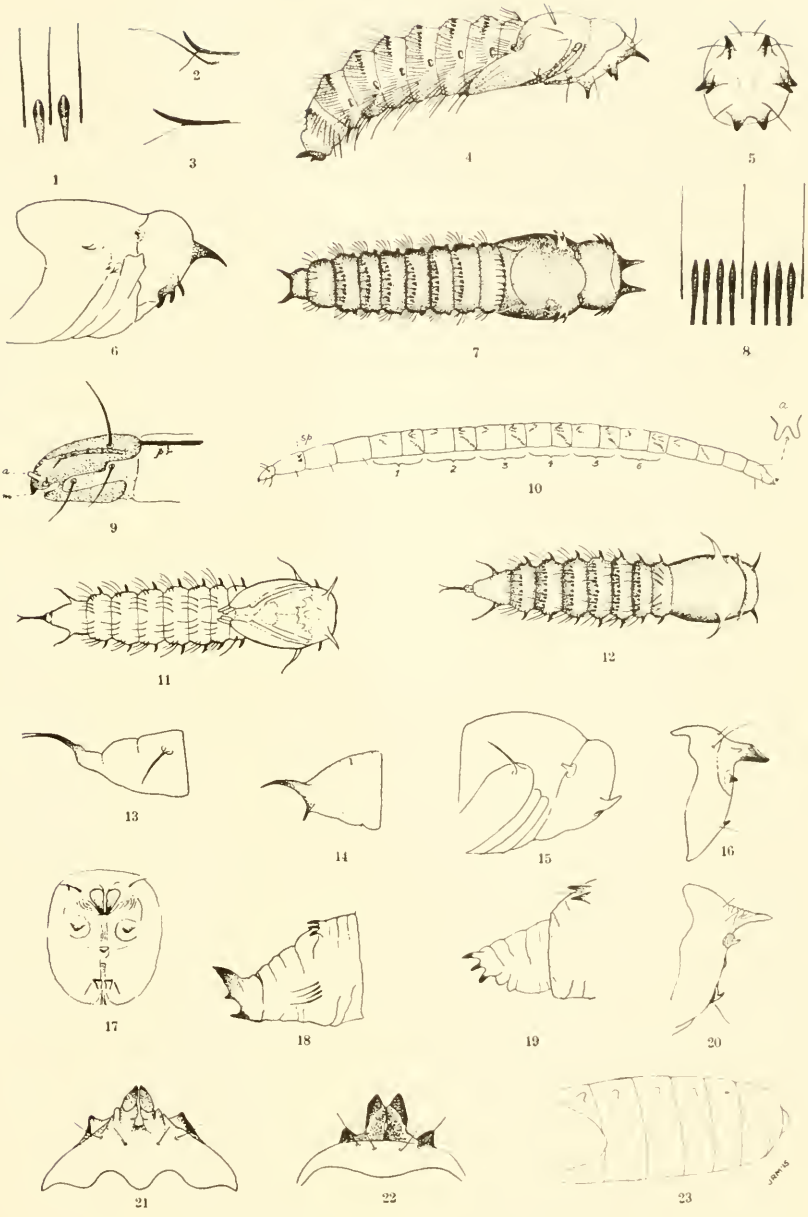

Plate LXXXII

Larval and Pupal Details of Asilidæ and Mydaidæ

Fig. 1. *Proctacanthus milberti*, ninth abdominal segment of pupa.
Fig. 2. *Promachus vertebratus*, seventh, eighth, and ninth abdominal segments of pupa.
Fig. 3. *Proctacanthus milberti*, end view of ninth segment of abdomen of pupa.
Fig. 4. *Promachus vertebratus*, side view of lateral cephalic thorn of pupa.
Fig. 5. The same, thorns at base of wing-case of pupa.
Fig. 6. *Proctacanthus milberti*, side view of lateral cephalic thorns of pupa.
Fig. 7. The same, thorns at base of wing-case of pupa.
Fig. 8. *Mydas clavatus*, dorsal view of apex of abdomen of pupa.
Fig. 9. The same, lateral view of pupa.
Fig. 10. The same, front view of head of pupa.
Fig. 11. *Promachus vertebratus*, ventral view of apex of abdomen of larva.
Fig. 12. The same, lateral view of larva.
Fig. 13. The same, posterior spiracle of larva.
Fig. 14. The same, dorsal view of apex of abdomen of larva.
Fig. 15. *Mydas clavatus*, lateral view of head of pupa.
Fig. 16. The same, side view of lateral cephalic thorn of pupa.
Fig. 17. *Asilus notatus*, thorn at base of wing-case of pupa.
Fig. 18. The same, side view of lateral cephalic thorn of pupa.
Fig. 19. *Proctacanthus milberti*, dorsal abdominal thorns of pupa.
Fig. 20. *Promachus vertebratus*, same as above.
Fig. 21. *Mydas clavatus*, same as above.
Fig. 22. *Proctacanthus milberti*, spiracular area of first abdominal segment of pupa.
Fig. 23. *Mydas clavatus*, abdominal spiracle of pupa.
Fig. 24. *Promachus vertebratus*, dorsal view of head of larva.
Fig. 25. The same, ventral view of head of larva.

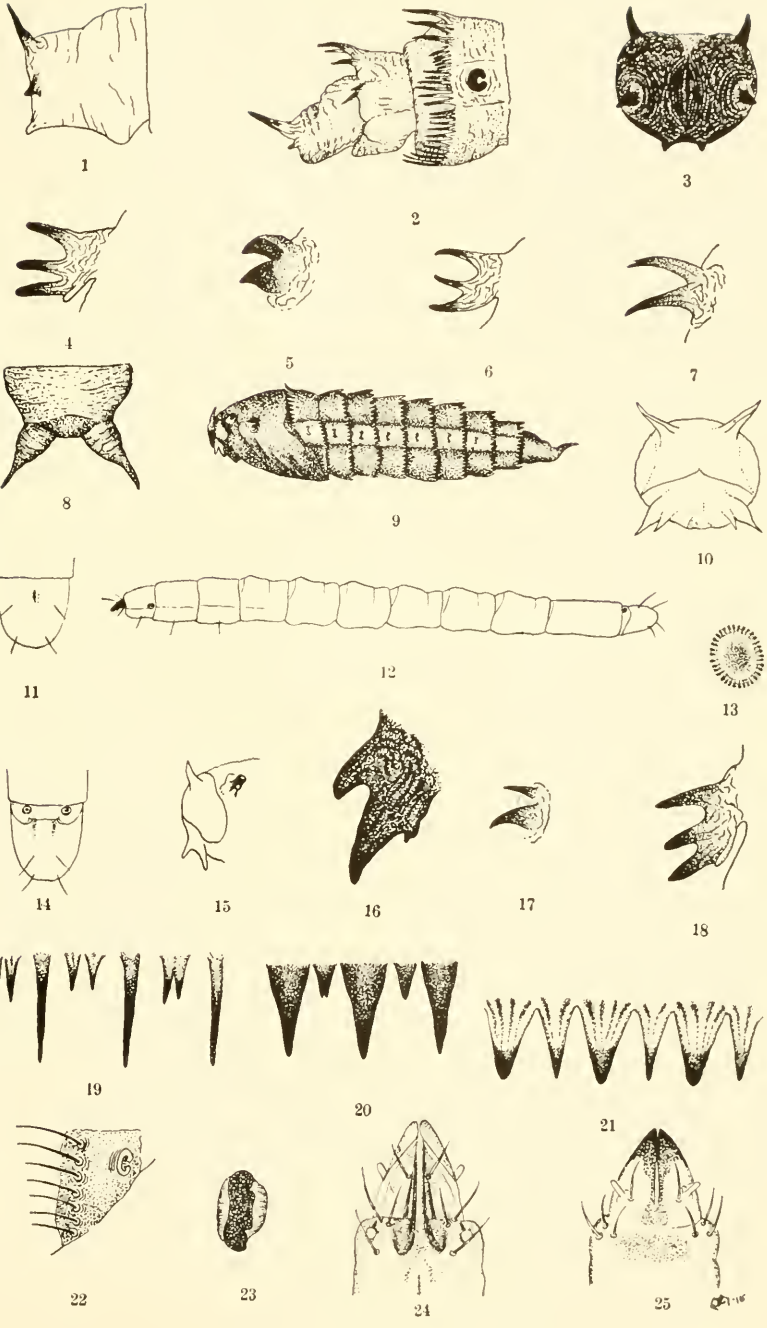
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Plate LXXXIII

Larval and Pupal Details of Bombyliidæ and Syrphidæ

Fig. 1. *Spogostylum anale*, dorsal view of head of larva. Retracted within prothoracic segment to point marked X.
Fig. 2. *Spogostylum anale*, dorsal abdominal bristles of pupa.
Fig. 3. *Exoprosopa fasciata*, same as above.
Fig. 4. The same, lateral view of apex of abdomen of pupa.
Fig. 5. *Sparnopolius fulvus*, same as above.
Fig. 6. *Exoprosopa fasciata*, lateral view of head of pupa.
Fig. 7. *Sparnopolius fulvus*, same as above.
Fig. 8. *Spogostylum anale*, dorsal view of apex of abdomen of pupa.
Fig. 9. The same, lateral view of head of pupa.
Fig. 10. The same, lateral view of apex of abdomen of pupa.
Fig. 11. *Exoprosopa fasciata*, dorsal view of apex of abdomen of pupa.
Fig. 12. *Brachypalpus frontosus*, dorsal view of larva.
Fig. 13. *Brachypalpus frontosus*, lateral view of puparium.
Fig. 14. *Brachypalpus frontosus*, front view of head and prothorax of larva.
Fig. 15. *Brachypalpus frontosus*, puparium, front view of lower margin of cephalic extremity, showing the remarkable change in position of the prothoracic thorns.
Fig. 16. *Ceria willistoni*, lateral view of puparium, anterior portion missing.
Fig. 17. *Tropidia quadrata*, lateral view of puparium.
Fig. 18. The same, anterior respiratory organ of puparium.
Fig. 19. The same, dorsal view of apex of abdomen of puparium.

Plate LXXXIII

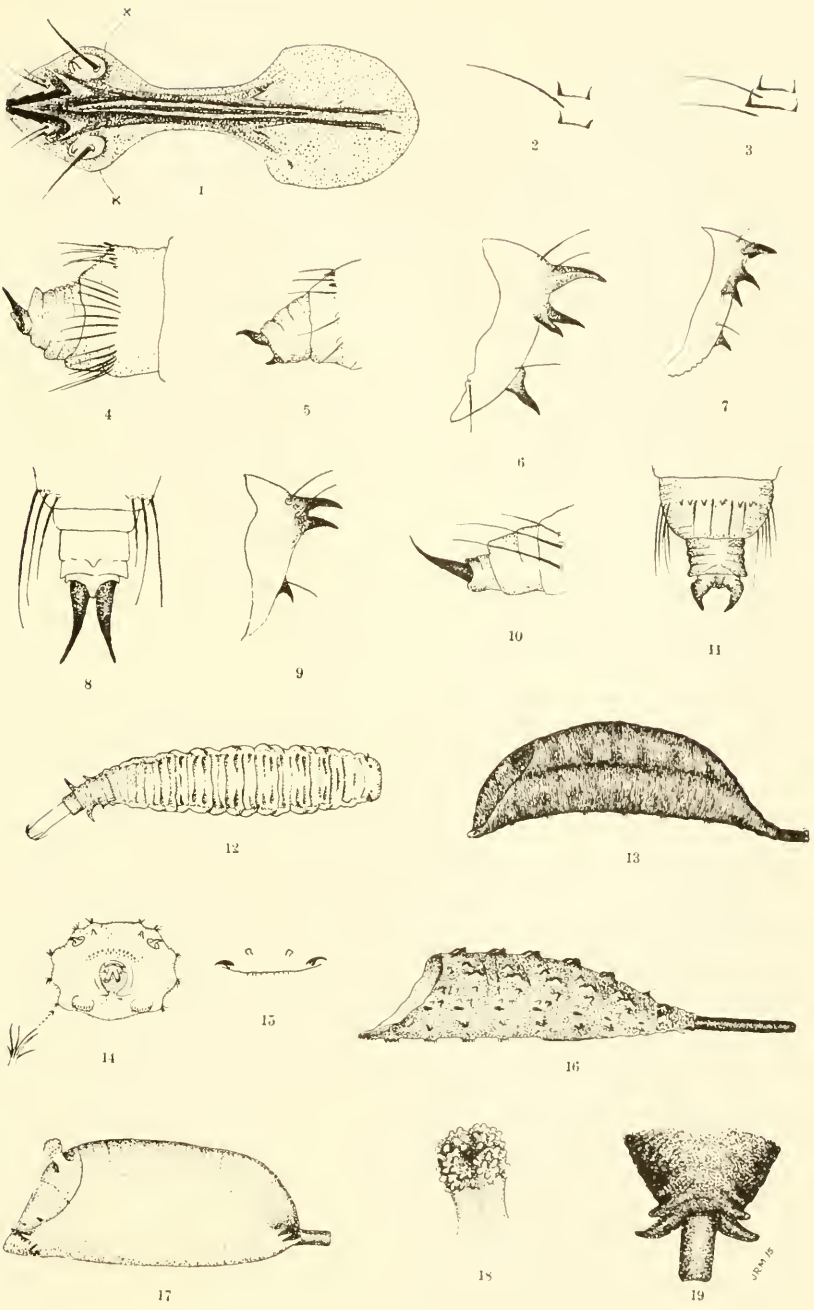

Plate LXXXIV

Larval, Pupal, and Imaginal Details of Diptera

Fig. 1. *Drosophila adusta*, dorsal view of puparium.
Fig. 2. *Agromyza angulata*, prothoracic respiratory organ of larva.
Fig. 3. The same, dorsal view of apex of abdomen of larva.
Fig. 4. *Agromyza aprilina*, lateral view of head of imago.
Fig. 5. *Drosophila dimidiata*, dorsal view of cephalic end of puparium.
Fig. 6. The same, dorsal view of apex of abdomen of puparium.
Fig. 7. The same, lateral view of apex of abdomen of puparium.
Fig. 8. *Agromyza pruni*, lateral view of larva.
Fig. 9. The same, lateral view of head parts of larva, more enlarged.
Fig. 10. *Agromyza pruni*, puparium, lateral view with dorsal and ventral views of apex of abdomen. The larva and puparium are drawn to the same scale and show the remarkable reduction in size due to the induration of the larval skin.
Fig. 11. *Agromyza pruni*, dorsal view of apex of abdomen of female of imago.
Fig. 12. *Agromyza angulata*, lateral view of puparium.
Fig. 13. *Hydrellia scapularis*, dorsal view of puparium, showing enclosed imago.
Fig. 14. *Agromyza parvicornis*, lateral view of larva.
Fig. 15. *Agromyza parvicornis*, puparium, lateral view and enlarged view of apex of abdomen. Drawn to same scale to show comparative reduction in size in pupal stage.
Fig. 16. *Hydrellia scapularis*, antepenultimate ventral segment of larva.
Fig. 17. *Platyphora flavofemorata*, imago, dorsal view of head and thorax: *h*, head; *sp*, spiracle; *pr*, prothorax; *m*, mesothorax; *ol*, overlapping portion of mesothorax; *pn*, postnotum.
Fig. 18. *Agromyza tiliæ*, prothoracic respiratory organ of puparium.
Fig. 19. The same, ventral view of apex of abdomen of puparium.

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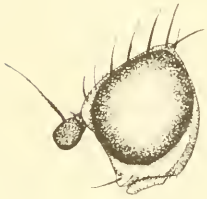

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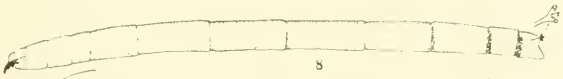

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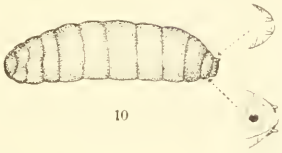

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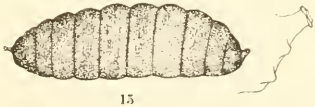

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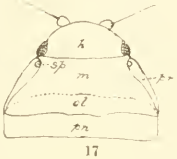

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J. R. MALLOCH.

FORMOSAN AGROMYZIDÆ.

FORMOSAN AGROMYZIDÆ.

By J. R. Malloch.

(Plates IX—X.)

The material upon which the present paper is based was collected in Formosa by Mr. Sauter and is now deposited in the Hungarian National Museum in Budapest.

The most striking feature about the material is the very large number of species included in it, which belong to the group with black halteres, and the comparative scarcity of other forms. The species belonging to the group most numerously represented in this material are very similar in general appearance to those which occur in America as gall makers, or as root or stem miners. The absence of any species in the genus *Agromyza*, with the costa carried only to the end of the third vein, is also a feature, though this is probably due to the fact, that this group is, as elsewhere, rather less numerously represented than the others.

While many of the *Agromyza* species included in this paper have much the habitus of some of those occurring in America and Europe, I have failed to identify satisfactorily any form but *pusilla* Meigen, which is possibly cosmopolitan and *longipennis* Loew. In the species *variihalterata*, we find a parallel to *maculosa* Malloch in the peculiar bicolored halteres, but there are many good characters by means of which they may be separated.

There is no indication on any of the material as to the habits of the species.

MILICHINAE.

Pseudorhicnoessa, nov. gen.

This genus may be separated from *Rhicnoessa* by the following characters. The orbits have one strong backwardly-directed bristle at about the transverse line of the anterior ocellus, one strong outwardly-directed bristle much below this one, and one or two, much shorter bristles, between this point and the base of the antennæ; the cruciate bristles on the center of the frons are represented by 2 or 3 pairs; the post-vertical bristles are strong and cruciate, otherwise the head is much as in *Rhicnoessa*. Thorax

bristled as in *Rhicnoessa*, but the dorso-centrals are stronger than is the rule in that genus. Legs formed as in *Rhicnoessa*, but both the mid and hind tibiæ have well developed bristles on the dorsal surfaces; no preapical bristle present. Wing with costal vein reaching only to third vein, the setulæ minute, very slightly increasing towards end of first vein; at the apex of the first costal division, there is a distinct small bristle, and a very indistinct break; anal cell distinct; anal vein subobsolete; outer cross vein at before wing middle. Squamæ very small.

This genus presents, in the bristling of the tibiæ, a character which I have not observed in *Rhicnoessa* or its allies, but the type species is so closely allied in other respects with this genus, that I have considered it advisable to associate it with *Rhicnoessa* in my description.

Pseudorhicnoessa spinipes n. sp.

Female: Head yellow; ocellar triangle, black, the surface obscured by gray pollen; back of head black, obscured with gray pollen; antennæ yellow, third joint brownish; arista brown; face and cheeks with whitish reflection. Thorax black-gray, opaque, covered with gray pollinosity; pleuræ with a brownish tinge, opaque. Abdomen slightly shining, black-brown, sides of the two basal segments yellowish, and a narrow, whitish yellow, hind marginal fascia on each segment, which is slightly interrupted on segments 3 to 5. Legs yellow, including the coxæ; all femora broadly browned on apices; tibiæ with apices browned; tarsi with the last two joints brownish. Wings clear; costa, first, third, and fifth veins brown, second and fourth veins indistinct, the latter especially so on its whole length. Squamæ and halteres yellow. Hairs and bristles black.

Ocellar bristles strong, divergent, widely separated at their bases; surface of frons with scattered short hairs; antennæ of moderate size, third joint rounded; arista thin, short, not longer than width of frons at anterior margin; head higher than long; cheek barely one-third as high as eye, marginal bristles in a single row, the bristles, increasing in length towards anterior angle, upcurved; vibrissa hardly stronger than last marginal bristle; proboscis fleshy, stout; palpi rather small. Mesonotum with 4 pairs of dorso-centrals; the disc with very numerous short setulæ, of which there are 6 rows between the dorso-centrals; disc of scutellum with similar setulæ. Abdomen with numerous surface hairs, those on the posterior and lateral margins of the segments bristle-like. Legs short-haired; mid tibiæ with 2 antero-dorsal bristles, and 3 very high-placed on the postero-dorsal surface, giving them the appearance of being almost on the dorsal surface; hind tibiæ with 3—4 antero-dorsal bristles, and 2 on the

dorsal surface, one before and one beyond the middle. (As these bristles are rather hair-like, I assume they will be subject to variation both in number and in position). Wing venation as figure 9.

Length: 2 mm.

One female, Takao, April 13, 1907.

Rhicnoessa Loew.

The three species represented amongst the material belonging to this genus have all been described by Prof. Hendel in a paper dealing with part of Sauter's material which is deposited in another collection.

The following table will serve to identify the species.

1. Cheek half as high as eye, or nearly so; inner cross vein at very little before middle of discal cell; last section of fifth vein subequal with penultimate section of fourth; wing veins heavy and dark, wing slightly grayish. *ochracea* Hendel.
— Cheek very distinctly less than half as high as eye. ..... 2.
2. Last section of fifth vein distinctly shorter than penultimate section of fourth; inner cross vein at about one third from base of discal cell. *sexseriata* Hendel.
— Last section of fifth vein distinctly longer than penultimate section of fourth; inner cross vein at about two fifths from base of discal cell. *fulva* Hendel.

Rhicnoessa ochracea Hendel.

Rhicnoessa ochracea Hendel, Suppl. Entomol. Nr. 2, 1912, p. 109.

Ten specimens from the following localities: Takao, January, March, April, and May 1907: Anping, April, 1912.

Rhicnoessa fulva Hendel.

Rhicnoessa fulva Hendel, id., p. 110.

Two specimens agreeing with the original description, Anping, October and April. Two specimens from Anping, April, and two from Tainan, February and April, are considerably darker in color, especially on the dorsum of the abdomen, which is almost black, and in being distinctly more slender in build. I do not separate this form from *fulva* as I consider that color alone is not a reliable guide to specific identity, and other characters are not constant throughout the series. While this is noticeable particularly in the venation, the last section of the fifth vein is distinctly longer than the penultimate section of fourth in all the specimens, which serves at once to distinguish the species from the following one.

Rhicnoessa sexseriata Hendel.

Rhicnoessa sexseriata Hendel, id., p. 110.

Four examples from the following localities: Anping, July, 1911, June, 1912; Takao, May 3, 1907, and April 23, 1907.

Desmometopa tarsalis Loew.

Desmometopa tarsalis Loew, Berl. ent. Zeitschr., 1865, p. 184.

Two examples of this species from the following localities: Takao, June 25, 1907, and Anping, April, 1912.

Mallochiella lacteipennis Hendel.

Madiza lacteipennis Hendel, Suppl. Entomol. Nr. 2, 1913, p. 108.

A single male agreeing with Hendel's description, Pilam, August, 1912.

The description of the female only is given by Hendel. The male differs in having the hind femora swollen, and the hind tibiæ spatulate as in *halteralis* Coq. The legs do not show the annulations mentioned by Hendel as present on the mid and hind tarsi, though a close examination shows the first three joints to be reddish with brown apices.

It may be well to mention that this species will fall into *Desmometopa* if regard is paid to the presence of the setulæ at the base of the wing, and the outcurving of the two upper pairs of orbital bristles. In other respects, the shining frons and body particularly, the species is obviously more closely related to *halteralis* than to *M-nigrum* and its allies, so that it may well be retained in *Mallochiella*.

Phyllomyza Fallén.

The species herein described are congeneric with those placed by Melander in his genus *Neophyllomyza*.[1] The only character which serves to distinguish the present species from the type of *Phyllomyza* is, that, in the latter, there are four pairs of dorso-central bristles, whereas in the species in *Neophyllomyza* there are only two. In other respects the generic characters are the same, and the species may the more readily be retained in *Phyllomyza* as within the limits of the group of species placed in *Neophyllomyza* there are characters, in the structure of the head especially,

[1] Journ. N. Y. Ent. Soc. 1913, p. 243.

which are in this family accepted as of generic value, though the number of dorso-central bristles is not so considered.

Table of species.

1. Cross veins closely approximated, the penultimate section of fourth vein not half as long as last section of fifth. ..... *approximata* Malloch.
– Cross veins not closely approximated, the penultimate section of fourth vein subequal with last section of fifth, or rather longer. ..... 2.
2. Palpi clear yellow, protruding, but not much broadened. .... *luteipalpis* n. sp.
Palpi black, much protruding, and very distinctly broadened ..... 3.
3. Palpi very long, equal to 1½ times the height of the head, paralell-sided, bare; halteres black, yellowish at base. ..... *nudipalpis* n. sp.
— Palpi broad and leaf-like, tapering to the apex, not as long as height of head; halteres yellow. ..... *dilatata* n. sp.

Phyllomyza approximata Malloch.

Phyllomyza approximata Malloch, Proc. U. S. Nat. Mus. vol. 46, 1913. p. 138.

One female evidently referable to this species from Pilam, August, 1912. Originally described from the Eastern United States.

Phyllomyza luteipalpis n. sp.

Male: Subopaque, brown-black. Frons, viewed from behind, subshining on orbits, and on ocellar triangle, opaque on central stripe, the latter brownish, becoming yellowish anteriorly; antennæ brown, the lower portions, and especially the underside of the third joint, yellowish; arista brown; face opaque, brownish, cheeks concolorous; palpi clear yellow; proboscis brown. Mesonotum and scutellum with grayish-brown pollinosity; pleuræ shining on the central portion. Abdomen brownish, subopaque. Legs yellow, femora browned, except at bases and apices, mid and hind tibiæ slightly obscured, but without distinct brown marks. Squamæ and halteres yellow. Wings clear, veins brown.

Upper pair of orbital bristles reclinate, the next two pairs directed out over the eye, the two lower pairs directed inwards; central, cruciate setulæ forming two weak lines; orbits widest on just below the third pair of bristles; a few short hairs are present on the orbits, in addition to the orbital bristles; antennæ large, third joint almost half as large as the eye; profile as fig. 2; arista hair-like, almost bare; proboscis short, the apical portion shorter than the subapical portion; palpi almost bare, not much dilated. Mesonotum with the posterior pair of dorso-centrals large, the

anterior pair, and the pair of bristles between the posterior pair, weak; discal setulæ, numerous, but not strong; apical pair of scutellar bristles long, the basal pair weak. Abdomen with short surface hairs. Legs with short hairs, the ventral surface of the femora with the hairs stronger; a distinct hair at apex of the mid trochanter, which is directed alongside of the femur. Wing as fig. 18.

Length 1–1·5 mm.

Locality: Takao, April 10, 1907.

Paratypes and allotype: Same locality, 300 m., March 31, 1907.

Female: Similar to the male, except in having the antennæ smaller, and in being rather larger over all.

Phyllomyza nudipalpis n. sp.

Male: Black. Fore tibiæ and all tarsi yellowish; mid pair and bases of hind pair, brownish-yellow. Mesonotum grayish-brown pollinose; pleuræ, with a shining black area in front of mid coxæ, the rest grayish pollinose. Abdomen subopaque. Palpi and halteres black. Squamæ grayish, the fringe dark.

The upper 3 pairs of orbital bristles directed outwards over the eye, the lower 2 pairs directed inwards; orbits distinct, slightly shining, the central stripe velvety-black; orbits with a few weak hairs in addition to the bristles; cruciate setulæ weak; profile as fig. 3; arista placed very near to the anterior upper angle of third joint, hair-like, with very slight pubescence; proboscis very much shorter than the much enlarged, bare palpi. Mesonotum with the same bristles as *luteipalpis*. Legs with short surface hairs. Wings as fig. 16.

Length: 2 mm.

Locality: Takao, 300 m., April 18, 1907. One male.

Phyllomyza dilatata n. sp.

Male: Orbits and frontal triangle shining black, center stripe deep black, opaque; antennæ, palpi and proboscis black. Mesonotum shining, black, with but slight signs of pollinosity; pleuræ glossy, with only slight pollinosity below wing base and posteriorly. Abdomen subopaque, black. Legs yellow, coxæ, and femora, except the extreme bases and apices, black-brown. Squamæ brownish, fringe brown. Halteres reddish yellow. Wings clear, veins brown.

Orbital bristles similar to those of *nudipalpis*, but much stronger, the second lowest pair much stronger than the lowest pair: the cruciate

central setulæ distinct; second antennal joint with a very distinct bristle at the apex, which is almost as long as the height of the third joint; third joint rounded; the arista not as near to the apex as in the last species, and rather more distinctly pubescent; cheek linear; profile as fig. 1; palpi leaflike; proboscis short, geniculated. Mesonotum and scutellum bristled as in *luteipalpis*. Legs with the hind femora thickened; several bristle-like hairs of the antero-ventral surface of hind femur from about the middle to the apex; all legs with numerous short surface hairs. Wings as fig. 17.

Length: 2·75 mm.

Locality: Toyenmongai. One male.

Milichiella lacteipennis Loew.

Lobioptera lacteipennis Loew. Berl. ent. Zeitschr., 1865, p. 185.

There is a single female of this very widely distributed species amongst the material taken at Tainan.

AGROMYZINAE.

Cerodonta acuticornis Meigen.

Agromyza acuticornis Meigen, Syst. Beschreib., VI, 1826, p. 175, 26.

Three examples, Takao, May 3, 1907, and one Tainan, February.

Table of species in Agromyza.

1. Frons, lateral margins of mesonotum, and disc of scutellum yellow..... 2.
— At least the scutellum entirely black. ..... 3.
2. Disc of mesonotum glossy black, the yellow color not carried across in front of the scutellum. ..... 1. *pusilla* Meigen.
— Disc of mesonotum dull grayish-black, the yellow color carried distinctly across in front of the scutellum. ..... 2. *subpusilla* n. sp.
3. Frons yellow. ..... 4.
— Frons black, or black brown. ..... 8.
4. Femora, entirely, or mostly, yellow, only sometimes slightly brownish at apices. ..... 5.
— Femora entirely black, or only the apices yellow. ..... 6.
5. Glossy black species, pleuræ black; femora entirely yellow. 3. *flavofemorata* n. sp.
— Dull, black-gray species; pleuræ yellow; femora more or less browned at apices. ..... 4. *formosensis* n. sp.
6. Legs entirely black..... 5. *frontella* n. sp.
— Legs with apices of femora clear yellow..... 7.

7. Frons clear lemon yellow; last section of fifth vein at most as long as penultimate section; generally shorter. 6. *longipennis* Loew, var. *nigricoxa* n. var.
— Frons brownish; last section of fifth vein distinctly longer than penultimate section. ..... 7. *brunnifrons* n. sp.
8. Apices of femora and bases of tibiæ, narrowly, but conspicuously yellow, contrasting with the other parts of the legs, which are brownish black. 7. *brunnifrons* n. sp.
— Legs unicolorous black, or at least with the knees not conspicuously yellow. . 9.
9. Halteres entirely yellow. ..... 10.
— Halteres at least partly black. ..... 16.
10. Squamæ yellow, or whitish, the fringe pale..... ..... 11.
— Squamæ brownish, the fringe concolorous. .... 12.
11. Mesonotum with 4 pairs of dorso-centrals. ..... 8. *flavisquama* n. sp.
— Two strong and one weak pairs of dorso-centrals on the mesonotum. . . 13.
12. Wings whitish, veins almost colorless; 6 pairs of bristles on the orbits. 9. *niveipennis* n. sp.
— Wings hyaline, veins distinct; 5 pairs of orbitals. .....10. *plebeia* n. sp.
13. Penultimate section of the fifth vein distinctly shorter than the last section; legs entirely black. ..... 11. *atrata* n. sp.
— Penultimate section of fifth vein distinctly longer than the last section; tarsi yellowish. ..... 14.
14. Small species, 1·5 mm; wings short and broad. ..... 12. *latipennis* n. sp.
— Larger species, 2 mm. and over, wings normal. ..... 15.
15. Tarsi black; inner cross vein at very distinctly before the middle of the discal cell, and before the end of first vein. ..... 13. *koshunensis* n. sp.
— Tarsi yellowish; inner cross vein at slightly before the middle of discal cell, and just below the end of first vein. ..... 14. *olesa* n. sp.
16. Squamæ white or yellow, fringe pale. ..... 17.
— Squamæ blackish or brownish, fringe dark. ..... 21.
17. Frontal triangle very broad, extending to lunule, metallic greenish black, at middle of frons occupying over one half the width of center stripe; eyes of male distinctly hairy on an area above, most readily seen from the side. 15. *obtusa* n. sp.
— Frontal triangle not very broad, with an acute apex, the sides rapidly converging anteriorly. ..... 18.
18. Large species, averaging over 3 mm; eyes of male distinctly hairy above, those of the female slightly pubescent. ..... 16. *lasiops* n. sp.
— Smaller species, averaging about 2·5 mm; eyes of male not hairy..... 19.
19. Mouth margin slightly produced; upper margin of basal joint of antenna at below the level of the middle of the eyes; inner cross vein at distinctly beyond the middle of the discal cell. .....17. *producta* n. sp.
— Species without the above combination of characters ..... 20.
20. Arista covered with dense pubescence which is at least twice as long as the basal diameter of the arista; cheek linear. ..... 18. *piliseta* n. sp.

— Arista tapering, almost bare, the pubescence never distinctly longer than the basal diameter of the arista; cheek distinct, though not broad. 19. *prolifica* n. sp.

21. Cheek produced into a distinct point anteriorly.. .... 20. *angulicceps* n. sp
— Cheek not angularly produced anteriorly. ..... 22.

22. Mesonotum with three pairs of dorso-central bristles. .... 21. *aliena* n. sp.
— Mesonotum with two pairs of dorso-central bristles. ..... 23.

23. Fore tibia with a distinct setula on the posterior side at about the middle.. 24.
— Fore tibia without such bristle. ..... 25.

24. Halteres entirely black. ..... 22. *setigera* n. sp.
— Halteres black, the apical part of the knob pale yellow. 23. *variihalterata* n. sp.

25. Subopaque black species; frons buccate; last section of fifth vein subequal with last section. ..... 24. *Sauteri* n. sp.
— Shining black species; frons not buccate. ..... 26.

26. Frontal triangle subshining; penultimate section of fourth vein subequal with the preceding section. ..... 25. *subfusca* n. sp.
— Frontal triangle glossy; penultimate section of fourth vein shorter than preceding section. ..... 27.

27. Small species, 1—1·75 mm. ..... 26. *atomella* n. sp.
— Larger species, 2·5—2·75 mm. ..... 27. *nigrisquama* n. sp.

1. Agromyza pusilla Meigen.

Agromyza pusilla Meigen, Syst. Beschreib., vol. 6, 1830, p. 185, species 60.

Specimens of this widely distributed species are amongst the material before me from the following localities, Tainan, Takao and Taihoku. Nine specimens in all.

2. Agromyza subpusilla n. sp.

Male: Yellow, subopaque. Head and all its parts, except the vertex and back, as well as the ocellar region, which are blackish, yellow. Mesonotum opaque, grayish-black on disc, the marking resembling that on the thorax of *melampyga* Loew, but the posterior yellow excisions not so clearly defined; the central one represented in type by a triangular mark; pleuræ with a slight darkening above fore coxa, and a large blackish-gray mark between mid and hind coxæ; scutellum blackened on each side at base; postnotum gray, yellow just below scutellum. Abdomen brownish, the posterior margins of all segments yellow. Legs yellow, tibiæ and tarsi slightly browned. Wings clear, veins black-brown. Squamæ yellow. Halteres yellow.

Orbits with four pairs of bristles, which are rather weak, and decrease

in size anteriorly; antennæ rather small, third joint rounded; arista slightly thickened, bare, and as long as length of frons; head in profile as fig. 6; Mesonotum with 2 pairs of strong and 2 pairs of much weaker dorso-centrals, the third and anterior pairs the weakest, the former being close to the suture; very few hairs on disc, no bristles discernable between the posterior pair of dorso-centrals; scutellum with four subequal bristles. Legs normal; no distinguishable bristles on mid tibia. Wing venation as fig. 5.

Length: 1·25 mm.

Locality: Tainan. One specimen.

3, **Agromyza flavofemorata** n. sp.

Male: Black. Head yellow, vertex, ocellar region and back of head black, orbits darkened posteriorly, becoming yellow anteriorly: third antennal joint reddish, the basal joints clear yellow; arista black-brown; palpi and proboscis yellow. Mesonotum and scutellum glossy black; pleuræ brown-black, opaque; postnotum black, becoming yellow just below the scutellum. Abdomen glossy black on dorsum, yellowish on venter; hypopygium black. Legs yellow, apices of tibiæ slightly, and the tarsi more distinctly browned. Wings clear, veins black, the base of wings yellowish. Squamæ yellow. Halteres yellow.

Orbits with four pairs of bristles, which decrease slightly in strength anteriorly, orbits wide, each about equal to half the width of the central stripe, very few weak hairs on the orbits in addition to the bristles; head in profile as fig. 7; arista with close and short pubescence; vibrissa slightly differentiated. Mesonotum with very slight grayish pollinosity on surface; 4 pairs of dorso-centrals present, the 2 anterior pairs weak; about three rows of weak hairs between the dorso-centrals anteriorly, and no bristles between the posterior pair of dorso-centrals; scutellum with 4 subequal bristles. Abdomen elongate, cylindrical: hypopygium slightly over the normal size; all abdominal segments covered with short hairs. Legs rather slender; mid tibia without distinct bristles on the posterior surface. Wing as fig. 15.

Length: 1·75.

Locality: Polisha. One specimen.

4. **Agromyza formosensis** n. sp.

Male: Yellow, subopaque. Head pale yellow, back of head, vertex, and ocellar region grayish, central stripe reddish yellow; third antennal joint with a large reddish-brown mark at the insertion of the arista, re-

mainder of antennæ pale yellow; arista brown; palpi and proboscis yellow. Disc of mesonotum broadly opaque gray, this color extending less distinctly to lateral margins; scutellum concolorous with the disc, in the male sometimes slightly yellowish; pleuræ yellow, spotted as in *subpusilla;* postnotum shining black. Abdomen yellow, each dorsal segment broadly browned on base, leaving only a narrow posterior yellow fascia; hypopygium yellow. Legs yellow, apices of fore femora slightly blackened dorsally, apices of other femora very indistinctly browned; all tibiæ and tarsi brownish yellow. Wings almost clear, veins brown, fifth vein indistinct at apex. Squamæ and halteres yellow.

Orbits with 3 pairs of bristles, which decrease slightly in size anteriorly, otherwise, generally, bare; profile almost as in *subpusilla;* arista thickened, the pubescence very indistinct; cheek with a few marginal hairs, the vibrissa very weak. Mesonotum with the bristling as in *subpusilla,* the area between the dorso-centrals bare, or with a few scattered, short hairs, forming two irregular rows. Abdomen elongate, narrow; hypopygium normal. Legs slender, no bristles on the posterior surface of the mid tibia. Wing venation almost as in *subpusilla,* the small cross vein generally slightly before the middle of the discal cell; last section of the fourth vein about six times as long as the penultimate section; last section of fifth vein about one and three-fourths the length of the penultimate section, generally evanescent on apical third.

Length: 1·5—1·75 mm.

Female: Similar to the male in color etc.; the ovipositor glossy brown-black. The wings are sometimes slightly grayish in this sex.

Locality: Taihoku. Seven specimens.

5. **Agromyza frontella** n. sp.

Female: Black, subshining. Head yellow, slightly ochreous; back of head, ocellar region, and upper half of orbits blackened; face brown in the depressions where the antennæ lie, the margins yellow; antennæ black; inner mouth margin glossy black; palpi and proboscis yellowish. Mesonotum with brownish pollinosity, scutellum concolorous; pleuræ shining black, the sutures and below wing base brown. Abdomen with slight indications of very narrow pale posterior margins to the segments; venter yellowish, most distinct on lateral margins at middle; ovipositor glossy black. Legs black, or black-brown. Squamæ brownish yellow, fringe concolorous. Wings clear, veins brown. Halteres yellow, knob white.

Four orbital bristles present, which are rather weak and decrease but slightly anteriorly, the upper two pairs directed backwards, the lower

two pairs directed inwards; orbits otherwise bare: width of each orbit less than half the width of central stripe, the bristles situated near to the eye margins; profile as fig. 8; arista very short, not longer than the width of the frons at the anterior margin, bare; eyes bare. Mesonotum with 2 distinct pairs of dorso-centrals, and in front of the anterior pair a series of setulæ, the most posterior of which is stronger than the others, and may be in some cases strong enough to rank as a dorso-central, in which cases the anterior setulæ will also be correspondingly increased in size; disc with numerous short hairs, about 8 rows between the dorsocentrals; no differentiated bristles between the posterior dorso-centrals. Abdomen subovate; ovipositor distinctly protruding, rather short and flattened. Legs moderately stout; mid tibiæ without discernable bristles. Wing as fig. 4.

Length: 1·25.

Locality: Pilam. August, 1912.

Allied to *A. gyrans* Fallén, but readily separated by the yellow palpi, which are exceptionally small, and the pale frons as well as other, minor, characters.

6. **Agromyza longipennis** Loew, var. **nigricoxa** n. var.

This variety differs from the type form in having the apex of the second joint of the antennæ clear yellow, contrasting sharply with the black base: the vibrissa less distinctly differentiated; and the fore coxæ blackened instead of yellow.

Longipennis Loew is very closely related to *geniculata* Fallén, the differences between which and the former I have pointed out in my recent paper on the genus *Agromyza*, in the Annals of the Entomological Society of America, vol. 6, 1913, No. 3. The pubescence of the arista in the form here listed is much less distinct than in the type form is, and possibly the examination of more material may result in the elevation of the former to specific rank.

Three specimens, Takao, May 3, 1907.

7. **Agromyza brunnifrons** n. sp.

Female: Black, shining. Frons black-brown, becoming black above the lunule; orbits shining, center stripe opaque; lunule yellow; antennæ black-brown, apex of second and base of third joints yellow; arista brown; face and cheeks pale yellow; proboscis and palpi yellow. Disc of mesonotum, scutellum, and pleuræ shining black, with slight indications of gray polli-

nosity; the narrow upper margin and vertical suture of pleuræ, as well as the usual patch below wing base, yellowish. Squamæ, their fringes and the halteres yellow. Abdomen black, rather glossy, the segments without pale margins; ovipositor glossy black. Legs black, shining, the apices of the femora and the bases of the tibiæ rather broadly clear yellow. Wings clear, veins black.

Frons over one third the head width: orbits with 4 pairs of bristles, which are not very strong and slightly decrease in strength anteriorly; antennæ rather small, third joint rounded, very slightly pilose; arista about as long as frons, the pubescence very short; face slightly receding, concave in profile, the cheek short and not over one sixth as high as eye; marginal bristles weak, vibrissa not strong. Mesonotum with four pairs of dorso-centrals, the anterior two pairs slightly weaker than the posterior two pairs; 5—6 rows of setulæ between the anterior dorso-centrals; no distinguishable bristles between the posterior pair of dorso-centrals. Abdomen elongate, narrow; surface hairs rather numerous and soft; hypopygium thick, not elongate nor flattened. Legs normal in shape, their surfaces short-haired; no bristles on mid tibiæ. Costa to the end of fourth vein; inner cross vein at slightly before the end of first vein, and at very slightly before the middle of the discal cell; veins 3—4 divergent on their last sections; last section of fourth vein about 6 times as long as the penultimate section; last section of fifth vein about 1½ times as long as the penultimate section.

Length: 2·25 mm.

Locality: Kosempo. One specimen, November.

This species is very closely allied to *longipennis* Loew, but the color of the frons is very different from that of the typical *longipennis*, and the wings in *brunnifrons* are also not so narow, while the venation also presents some considerable differences.

8. **Agromyza flavisquama** n. sp.

Female: Black, shining. Proboscis, squamæ and their fringes, and the halteres yellow. Legs black, fore tibiæ, and all the tarsi, except their apices, yellowish. Wings slightly grayish, the veins very distinct, black-brown.

Frons not quite one third the head width, opaque, only the ocellar region and the orbits at the bases of the bristles shining; orbits poorly defined, their inner margin hardly discernable from the central stripe; four pairs of orbital bristles present, which decrease much in length anteriorly, anterior pair only incurved; orbits without hairs in addition to the bristles, the

latter situated on near to the eye margin; antennæ normal in size, the upper surface of the basal joint at just about the middle of profile, second joint with a short apical bristle on the dorsum, third joint slightly elongate, apex rounded, pilosity very short; arista very little thickened at base, pubescence very short, length of arista slightly short of from its base to the base of upper orbital bristle; face concave in profile; cheek linear, not over one tenth the height of the eye, margin with slight hairs, the vibrissa slightly differentiated. Mesonotum with 4 pairs of dorso-centrals, the two anterior pairs distinctly reduced in size; discal setulæ numerous, about 8 rather irregular rows between the anterior dorso-centrals; the pair of bristles between the posterior dorso-centrals distinct. Abdomen ovate, the surface hairy; ovipositor short and broad. Legs stout; the two bristles on the mid tibia strong. Wings slightly elongate, venation as fig. 14.

Length: 3·5 mm.

Locality: Chip-Chip. One specimen, March.

9. Agromyza niveipennis n. sp.

Male: Black, slightly shining. Frons opaque, brown-black, the orbits subopaque; face brownish; palpi and proboscis black. Squamæ and the fringes yellowish-white. Legs black, fore tibiæ and the bases of all the tarsi brownish yellow. Wings whitish, the veins vitreous, with the exception of the costa, which is brown. Halteres yellow, knob whitish.

Head rather large, the frons slightly buccate, the face slightly retreating; width of frons one third that of head, orbits distinct, each about equal to one third the width of the central stripe, six pairs of orbital bristles present, which are situated on near to the inner margin, and decrease sligthly in length anteriorly, the orbits otherwise almost bare; antennæ of good size, third joint slightly acute at the apex on the upper side, arista about $2\frac{1}{2}$ times as long as the third joint of the antennæ, almost bare, and very thin except at the base; cheek linear at the anterior margin, becoming about twice as high at the posterior margin, where it is not more than one sixth the height of the eye, marginal bristles distinct, the vibrissa weakly differentiated. Mesonotum with 2 strong and 1 weak pairs of dorso-centrals, the pair of bristles between the posterior pair of dorso-centrals strong; discal setulæ numerous, and in the line of the dorso-centrals rather strong. Abdomen broadly ovate; hypopygium very similar to that of *parvicornis* Loew. Legs strong, the mid tibia with the posterior bristles distinct. Wing with the inner cross vein at the middle of the discal cell; the last section of the fourth vein about $2\frac{1}{2}$ times as long as the penultimate section,

which is about equal in length with the last section of the fifth vein; costa to end of fourth vein.

Length: 2·75 mm.

Female: Similar in coloration to the male, differing only in being rather larger, in having the mesonotum less hairy, and the ovipositor distinctly protruding, and almost identical with that of *parvicornis*.

Locality: Takao, May 3, 1907. One male and one female.

This species is very close to *parvicornis* Loew, differing chiefly in the structure of the head, the chætotaxy of the mesonotum and the color of the wings.

10. Agromyza plebeia n. sp.

This species is so similar to *niveipennis* that it will be sufficient to indicate merely the points of difference.

The color throughout is more brownish; the orbits have only 5 pairs of bristles; the tarsi are paler in color; the wings are not whitish, but have a slightly yellowish tinge, and their veins are distinct; while in the female the third and fourth veins are more distinctly divergent than in *niveipennis*.

Length: 2·5 mm.

Locality: Takao, May 3, 1907. One male and one female.

11. Agromyza nigrita n. sp.

Female: Deep black, slightly shining. Apex of proboscis brown. Knob of halteres clear yellow. Legs black, the tibiæ slightly brownish. Wings clear, veins black. Squamæ grayish the margins and fringe almost black.

Frons opaque, the orbits distinctly glossy at bases of the bristles; frons about one third the width of the head, parallel-sided; orbits slightly differentiated from the center stripe, rather narrow, each about one fourth as wide as the center stripe; four pairs of strong orbitals present, situated about the middle of the orbits longitudinally, decreasing in size anteriorly, the orbits otherwise bare; frontal triangle not differentiated, ocellar region not shining; antennæ moderate in size, third joint rounded, very indistinctly pilose; arista very little swollen at base, and for a very short distance, bare; length of arista equal to from its base to upper orbital bristle; face slightly retreating; cheek linear, but little higher posteriorly than anteriorly, maginal bristles of moderate strength, vibrissa slightly differentiated. Mesonotum with four pairs of strong dorso-centrals, the anterior two pairs weaker than the posterior two pairs, the pair of bristles between the posterior dorso-centrals distinct, discal setulæ not very close, but strong, about 10 rows between the anterior dorso-centrals. Abdomen short, broad at base

the sides tapering much to the apex; ovipositor projecting, circular in cross section, not elongated. Legs strong, mid tibia with distinct posterior bristles. Wing venation as fig. 12.

Length: 2·75—3·5 mm.

Locality: Pilam, August, 1912.

Paratypes: Takao, April and May, 1912. Three females.

12. **Agromyza latipennis** n. sp.

Male: Black, shining. Apex of proboscis brownish. Halteres yellow, the knobs white. Legs black, the tibiæ and tarsi brownish-black. Squamæ brown, the margins and the fringes dark brown. Wings clear veins black.

Frons slightly less than one third the width of the head, almost parallel-sided, orbits slightly differentiated from the central stripe, glossy at the bases of the bristles, otherwise subopaque; ocellar triangle distinct, glossy; four pairs of orbital bristles present, the two upper pairs backwardly directed the two lower pairs inwardly directed, the bristles decreasing much in length anteriorly, the anterior pair mere hairs, orbits otherwise bare; antennæ above the average in size, third joint rounded at apex, distinctly pilose; arista tapering, rather thick, the pubescence distinct though short; length of arista equal to from its base to upper orbital bristle; face distinctly retreating; cheek linear, slightly higher posteriorly. Mesonotum with 3 pairs of dorso-centrals, the anterior pair weak; cephalad of the anterior pair of bristles there is sometimes a setulose hair stronger than the discal setulæ, which is posterior to the suture; the pair of bristles between the posterior dorso-centrals distinct; discal setulæ rather numerous, about 8 rows between the anterior dorso-centrals. Abdomen short and broad, the surface with rather long brownish hairs; hypopygium glossy black. Legs normal in shape; the two bristles present on the posterior surface of the mid tibia. Wing very broad, veins fine and very distinct: fig. 13.

Length: 1·25 mm.

Locality: Takao, 300 m. alt., March 31, 1907.

Female: Similar to the male in coloration and chætotaxy; the ovipositor is highly glossy, and distinctly protruding. In size slightly larger than the male.

Allotype and paratype: Same data as the type.

13. **Agromyza koshunensis** n. sp.

Male: Black, shining. Frontal lunule white pollinose; center stripe of frons opaque, orbits and ocellar region shining; antennæ and palpi black;

proboscis brown at apex. Squamæ gray, margins and the fringe black-brown. Abdomen brown-black, becoming paler towards the apex. Legs entirely black. Wings clear, veins black, very fine, but distinct. Halteres brownish on stem and outer side of the knob, the greater part of the knob creamy white.

Frons one third the width of the head; three pairs of very strong bristles on the orbits, the fourth, anterior, pair very weak and hair-like; antennæ normal in size, dorsal bristle on second joint very small, third joint rounded; arista slender, almost entirely bare, as long as from its base to the upper orbital bristle; cheek short, barely twice as long as its greatest height, and at that part barely one eighth as high as eye; marginal bristles increasing in size anteriorly, vibrissa strong and well differentiated. Mesonotum with 2 pairs of strong dorso-centrals; the two bristles between the posterior pair of dorso-centrals strong; disc very thickly covered with very short setulæ. Mid tibia with the bristles on the posterior surface strong. Wing with the inner cross vein at one third from base of discal cell and well in front of the end of first vein; last section of fourth vein about one and two third times the length of the penultimate section; last section of fifth vein two thirds as long as the penultimate section; veins 3 and 4 subparallel on their last sections.

Length: 2·75 mm.

Locality: Koshun, October, 1908.

This species has much the habitus of the species belonging to the section with the halteres black, the stout build and the chætotaxy being very similar to that of those species, though the bristles between the posterior dorso-centrals are present in *koshunensis*.

14. **Agromyza obesa** n. sp.

Male: Black, shining. Differs in color from the previous species in having the abdomen entirely black, the tarsi of all the legs yellowish, the halteres yellow with white knob, and the wing veins brown.

Differs from *koshunensis* as follows: Orbits with three bristles which are subequal in size; arista with short but distinct pubescence; cheek linear throughout, almost indistinguishable; mesonotum with three distinct dorso-centrals, the size decreasing anteriorly, discal setulæ much less numerous and stronger than in *koshunensis;* abdomen broadly ovate as in that species; legs rather hairy, the bristles on the mid tibia not so strong; the inner cross vein at slightly before the middle of the discal cell and at just below the end of the first vein; the last section of fourth vein is $2\frac{1}{2}$ times

as long as the penultimate section; and the last section of the fifth is about three fifths as long as the penultimate section.

Length: 3 mm.

Locality: Sokotsu, May, 1912. One specimen.

15. Agromyza obtusa n. sp.

Male: Glossy black. Frons opaque black, orbits and frontal triangle glossy black, with a slight greenish tinge; frontal lunule white pollinose; antennæ, arista, and palpi, black, proboscis brown at apex. Mesonotum and pleuræ with a blue-green tinge, which at some angles presents a violaceous shade. Abdomen glossy black, the surface metallic, in some lights bronzy, in others with a violaceous tinge on a greenish-blue ground. Legs shining black. Wings clear, veins brown, yellowish at their bases. Squamæ white, fringe concolorous. Halteres black.

Frons very slightly over one third the width of head; frontal triangle broad and well defined, its sides gradually converging anteriorly, and slightly convex; orbits distinct, with slight swellings at the bases of the bristles; 4 pairs of orbitals present, which are very stout and decrease but little in strength anteriorly, the anterior 2 pairs directed inwards, the 2 posterior pairs directed backwards; antennæ of moderate size, second joint with the dorsal bristle distinct, third joint rounded; arista slightly tapering at base of last section, the pubescence distinct, very fine, and not closely placed; eyes pubescent, a small area on the upper surface very distinctly haired; cheek almost linear, slightly higher on the posterior half, marginal hairs very numerous, but not strong, the vibrissa not differentiated. Mesonotum with 2 pairs of strong dorso-centrals, and sometimes a weak pair of setulæ in front of the anterior pair; discal hairs short and closely placed, 8—10 rather irregular rows between the anterior dorso-centrals; no distinct bristles between the posterior dorso-centrals. Abdomen broadly ovate; discal hairs strong and numerous, but not long; hypopygium normal. Legs strong, femora slightly thickened; fore tibia with a short setula on the posterior surface at about the middle; mid tibia with the two posterior setulæ present, but not very strong. Wings of normal breadth; inner cross vein at, or very slightly on either side of, the middle of the discal cell; last section of fourth vein about 3 times as long as the penultimate section; last sections of veins 3 and 4 slightly divergent; last section of fifth vein about three fifths as long as penultimate section.

Length: 2·75—3 mm.

Female: Similar in coloration to the male. Differing as follows: The eyes are very indistinctly pubescent; the orbits have more distinct short

surface hairs than in the male, in addition to the bristles: the ovipositor is much exserted and rather tubular; the wings are slightly broader, and the third and fourth veins more distinctly divergent apically.

Length: 2·75—3·5 mm.

Locality of type: Sokotsu, May, 1912.

Locality of allotype: Takao, April 10, 1907.

Paratypes: Takao, November 8, 1907, and March 31, 1907; Yentempo, May 19, 1907; and Tainan, no date.

16. **Agromyza lasiops** n. sp.

Male: Glossy black. Mesonotum with a slight bronzy luster. Abdomen with a distinct blue-green tinge, in some lights with a slight cupreous luster. Frons black, center stripe opaque, orbits and triangle glossy. Antennæ, palpi, and proboscis black, the latter brown at apex. Legs black. Wings clear, veins black. Squamæ yellow, fringe concolorous. Halteres black.

Frons slightly less than one third the width of head, narrowed but little anteriorly; orbits narrow, width of each at widest part not more than one sixth the width of center stripe at same part; 4 pairs of almost equally strong orbital bristles present, and in addition a few weak hairs near to the eye margin, extending from anterior extremity to upper orbital bristle; lunule large, white pollinose; antennæ inserted slightly below middle of profile, second joint with distinct bristle, third joint rounded, of moderate size; arista tapering, reaching to upper orbital, pubescence fine, but distinct; eye very large, covering almost the entire side of the head, shortly pubescent, but with an area on upper surface which is distinctly hairy; cheek linear, marginal hairs very fine and numerous; vibrissa very weak. Mesonotum with 2 pairs of dorso-centrals; disc very densely covered with short hairs, which are indiscriminately arranged. Abdomen subovate, the surfaces of the segments covered with short hairs which are very closely placed; hypopygium of normal size, with 2 slightly projecting apical lamellæ. Legs strong; fore tibia with a posterior setula at about the middle; mid tibia with 2 rather strong setulæ. Auxiliary vein joining costa, almost fused with first vein near to its apex; inner cross vein at, or slightly beyond, middle of discal cell, and below end of first vein, slightly acute, its lower extremity sloping away from wing base; last section of fourth vein about three times as long as penultimate section; last section of fifth vein two thirds as long as penultimate section; last section of fourth vein slightly undulating, see fig. 11.

Lengtlr: 3·5 mm.

Locality: Kosempo, June.

Female: Similar to the male in color etc. The ovipositor is highly glossy, and protrudes as far as the length of the last abdominal segment. As in the male, the frontal triangle does not reach beyond middle of frons, and is acute at apex. The eyes are only slightly pubescent.

Allotype: Tainan, April, 1912.

Paratypes: Yentempo, Chip-Chip, Tapani and Toyenmongai.

17. **Agromyza producta** n. sp.

Male: Black, distinctly shining. Frons opaque, orbits and frontal triangle glossy; antennæ, arista, face, cheeks, palpi, and proboscis black. Mesonotum with a slight bluish, or greenish, luster. Abdomen glossy black, dorsum with a bluish luster at base, becoming violaceous on apical half; hypopygium black. Wings clear, veins fine, black. Squamæ whitish, fringe concolorous. Halteres brown-black.

Frons slightly over one third the width of head, but little convergent anteriorly; triangle very distinct, elongated, the apex acute, reaching to well beyond the middle; orbits narrow, distinct, each about one fourth as wide as center stripe; 4 pairs of orbital bristles present, the upper about equal in length to one third the eye height, the others slightly decreasing in size anteriorly, no distinguishable orbital hairs present; antennæ inserted slightly below middle of profile, second joint with short, but distinct, dorsal bristle, third joint small, rounded; arista bare, but little swollen at base, as long as from its base to between the 2 upper orbital bristles; cheek about one fourth the height of eye, anterior angle distinctly produced, marginal hairs weak, vibrissa stout, but not long. Mesonotum with 2 pairs of strong dorso-centrals; discal setulæ short, hair-like, very closely placed. Abdomen broadly ovate, surface with numerous short hairs; hypopygium normal. Legs rather slender; mid tibia with the posterior pair of bristles weak and widely separated. Wings normal in shape; inner cross vein at just beyond end of first vein and distinctly, though not greatly, beyond middle of discal cell; last section of fourth vein about 5 times as long as penultimate section; last sections of veins 3 and 4 subparallel; last section of fifth vein two thirds the length of penultimate section.

Length: 1·5 mm.

Type: Pilam, August, 1912.

Female: Similar to the male in color and size. Ovipositor highly glossy, much protruded, tapering, circular in cross section; wings broader than in the male, the inner cross vein more distinctly beyond the middle

of discal cell than in the latter, and the outer cross vein fully as long as the section of fourth vein anterior to it.

Allotype: Tainan, October.

Paratypes: Two females, Tainan, February.

18. **Agromyza piliseta** n. sp.

Male: Glossy greenish black. Frontal triangle and orbits glossy black, center stripe opaque; apex of proboscis brown. Mesonotum with slight indications of grayish dusting. Abdomen with a distinct violaceous tinge on the basal half of the dorsum. Legs glossy black. Wings clear, veins distinct, black. Squamæ whitish yellow, fringe concolorous.

Frons about one third the head width, the sides slightly convergent anteriorly; orbits distinct, their surfaces with slight hairs in addition to the 4 pairs of bristles, the latter only of moderate strength, and decreasing slightly anteriorly; triangle narrow, acute, generally reaching to beyond middle of frons; cheek linear, about one tenth the height of the eye, marginal hairs distinct, vibrissa weakly differentiated. Mesonotum with 2 pairs of dorso-centrals. Abdomen ovate; hypopygium normal. Mid tibia with the posterior bristles distinct. Inner cross vein at middle of discal cell, or very slightly on either side of the middle; last section of fourth vein about 3 times as long as penultimate section; last section of fifth about two thirds as long as penultimate section; veins three and four distinctly divergent on their apical sections.

Length: 2—3 mm.

Female: Similar to the male, except that it is rather larger and more robust, besides having the abdomen more greenish, and with less distinct violaceous color on the dorsum.

Type: Takao, October 26, 1907.

Allotype: Tainan, April, 1912.

Paratypes: Takao, Tainan, and Kosempo, 4 specimens.

19. **Agromyza prolifica** n. sp.

This species is very similar to the foregoing and may be separated from it by the following characters:

The antennæ are slightly larger; the arista is without the distinct pubescence, and appears much thinner and tapering; the cheek is about one sixth the eye height, the marginal hairs are very weak, and the vibrissa is well differentiated; the inner cross vein is at beyond the middle of the discal cell; the last section of the fourth vein is 4 times as long as the

penultimate section; and the size of the specimens averages barely over 2 mm.

Type: Chip-Chip, February.

Paratypes: Chip-Chip; Tainan; and Takao, various dates. Fifty-two specimens.

Some of the examples show considerable variation in the situation of the inner cross vein and rarely it is very slightly beyond the middle of the discal cell. I consider, however, that there is only one species in the series before me, as in some species of this group there is considerable variation.

20. Agromyza anguliceps n. sp.

Female: Glossy black. Center stripe of frons opaque black; apex of proboscis yellowish. Pleuræ and ventral surface of abdomen subopaque black. Legs glossy black. Wings clear, veins black. Squamæ grayish, fringe brown. Halteres black the stalks brown.

Frons slightly over one third the width of head; orbits distinct, narrow, each equal to less than one fourth the width of central stripe, 4 pairs of orbitals present, which are not strong and decrease slightly in length anteriorly, the anterior pair strongly incurved; a few very short hairs on the orbits in addition to the bristles; triangle distinct, highly glossy, narrow, extending to beyond middle of frons; antennæ inserted well below middle of profile, small, third joint rounded; arista bare, swollen at base, the apical portion very thin, entire length about equal to two thirds that of frons; face concave; frons declevitous; cheek about equal to one eighth the height of eye, very distinctly produced at anterior angle, its anterior extremity being in vertical line with the anterior margin of third antennal joint, marginal hairs weak, vibrissæ well differentiated. Mesonotum with 2 pairs of dorso-centrals; disc with numerous short, hairlike setulæ. Abdomen ovate; ovipositor stout; surface of abdomen and ovipositor with numerous hairs. Legs slender; the mid tibial bristles weak but distinct. Inner cross vein at beyond end of first vein and at one third from end of discal cell; last section of fourth vein about 6 times as long as penultimate section; veins 3 and 4 slightly divergent; last section of fifth vein two thirds as long as penultimate section; auxiliary vein complete.

Length: 2 mm.

Type: Tainan, February.

This species belongs to the group in which the male has the vibirssal angle distinctly produced, and the vibrissæ in the form of fasciculi.

21. **Agromyza aliena** n. sp.

Female: Glossy black, becoming more brownish towards apex of abdomen. Center stripe of frons opaque black; frontal lunule brown; cheeks opaque, brownish; apex of proboscis pale brownish. Pleural sutures and below wing base yellowish brown. Legs brown-black. Wings slightly grayish, veins black. Squamæ gray, fringe black-brown. Halteres black-brown, paler on the inner surface.

Frons distinctly over one third the width of head; orbits distinct, each about one fifth as wide as center stripe; 4 pairs of moderate-sized orbital bristles present, which decrease slightly in size anteriorly, the anterior two pairs incurved; several short hairs on orbits, in addition to the bristles; frontal triangle indistinct, only glossy on a very narrow stripe below ocelli; antennæ of moderate size, inserted below middle of profile, dorsal bristle on second joint distinct; third joint slightly longer than broad, rounded at apex; arista swollen at base, tapering, slightly pubescent, its entire length almost equal to that of frons; face concave; cheek about one sixth as high as eye, marginal hairs numerous, vibrissa differentiated. Mesonotum with 3 pairs of dorso-centrals, the anterior pair weak; discal setulæ numerous, but not long, about 10 rows between the dorso-centrals; no strong bristles between the posterior dorso-centrals; the setulæ carried to the posterior margin. Abdomen broadly ovate; surface with distinct hairs, which become bristle-like on the posterior and lateral margins; ovipositor tapering, glossy black. Legs normal in shape; mid tibia with the posterior bristles distinct. Inner cross vein at below end of first vein and at two fifths from apex of discal cell; last section of fourth vein 4 times as long as penultimate section; veins 3 and 4 distinctly divergent; last section of fifth vein two thirds as long as penultimate section.

Length: 2·75 mm.

Type: Sokotsu, May, 1912.

22. **Agromyza setigera** n. sp.

Female: In coloration identical with *varihalterata* except that the halteres are unicolorous black-brown.

Frons slightly less than one third the width of the head; center stripe opaque, orbits shining; each orbit about one fourth the width of center stripe, distinct; 4 pairs of orbital bristles present, the three upper pairs strong, the anterior pair weak, incurved; hairs on orbits weak, but numerous; frontal triangle indistinct, only represented by a narrow glossy stripe below the ocelli; antennæ as in *varihalterata;* cheek short, narrow,

not one-eighth as high as eye; marginal hairs numerous; vibrissa well differentiated. Mesonotum, abdomen, and legs as in *variihalterata*. Wing with the inner cross vein at middle of discal cell and at below end of first vein; last section of fourth vein 3^1_2 times as long as penultimate section; last sections of veins 3 and 4 subparallel; last section of fifth vein over two thirds as long as penultimate section.

Length: 3—3·75 mm.

Type: Tainan, April, 1912.

Paratypes: Tainan, May, 1912: Takao, 300 m., April 18, 1907, two specimens; Koshun, September; Kankau, August, 1912. A female from Takao, April, 1907, has the last sections of the third and fourth veins slightly divergent, but in other respects agrees with the type.

23. **Agromyza variihalterata** n. sp.

Male: Glossy black. Frons, including the triangle, opaque black, the orbits glossy; lunule white pollinose; face and cheeks opaque black; apex of proboscis yellowish. Mesonotum and pleuræ with slight brownish pollinosity. Abdomen with a slight indication of a greenish luster. Legs subopaque black. Wings clear, veins black. Squamæ grayish, margins and fringe black. Halteres black, apex of knob whitish.

Frons one third as wide as head; orbits distinct, each about one third as wide as center stripe, 4 pairs of moderate-sized orbital bristles present, which decrease slightly in strength anteriorly, the anterior pair incurved, orbits otherwise bare; frontal triangle not discernable; antennæ normal in size, inserted below middle of profile, second joint with short dorsal bristle, third joint rounded; arista almost bare, tapering, almost as long as frons; cheek short and narrow, not more than one-eighth as high as eye, marginal hairs distinct, vibrissa well differentiated. Mesonotum with 2 pairs of dorsocentrals, otherwise as in *aliena*, except that the setulæ are not carried as far posteriorly. Abdomen ovate; lamellæ of hypopygium elongated, their length equal to that of the last abdominal segment; hairs on abdomen not so conspicuous as in *aliena*. Legs rather slender; fore tibia with a setula on the posterior surface at about the middle; mid tibial bristles longer than in allied species, the upper one being much longer than the diameter of the tibia. Inner cross vein at before the end of first vein and at one third from base of discal cell; last section of fourth vein about 2^1_2 times as long as penultimate section; last sections of veins 3 and 4 gradually divergent; last section of fifth vein three fourths as long as penultimate section; auxiliary vein complete.

Length: 2·75 mm.

Type: Koshun, March.

24. **Agromyza Sauteri** n. sp.

Male: Black, subopaque, abdomen slightly more shining than the thorax. Wings slightly brownish, veins very distinct, slightly thickened, fuscous black. Squamæ, their fringes, and the halteres black-brown.

Frons at vertex over one half the head width, slightly narrowed anteriorly; orbits broad, each over one third the width of center stripe, distinct, 4 pairs of hair-like orbitals present (on one side 5) which do not decrease much in size anteriorly, and are with the exception of the upper pair incurved; hairs on orbits distinct and rather long; frontal triangle poorly defined, subtriangular; antennæ below the normal in size, upper margin of basal joint above middle of profile, third joint rounded; arista thickened on its basal third, almost bare, its entire length about $2\frac{1}{2}$ times as long as antenna, and equal to anterior breadth of frons; face receding; frons buccate, very distinctly visible on its entire length above eyes when viewed laterally; cheek about one fifth the eye height, marginal hairs distinct, vibrissa differentiated. Mesonotum with 2 pairs of dorso-centrals, which are subequal in length; disc with rather long setulæ, which do not extend much beyond the transverse line of the anterior dorso-centrals. Abdomen subovate, surface with numerous hairs; hypopygium normal. Legs normal; mid tibia with the posterior bristles present, but weak. Inner cross vein at just beyond end of first vein and at one third from apex of discal cell; last section of fourth vein 5 times as long as penultimate section; last section of fifth vein subequal with penultimate section; sixth vein reaching three-fourths of the length to wing margin.

Length: 2·5 mm.

Type: Chip-Chip, February.

25. **Agromyza subfusca** n. sp.

Male: Black, shining, abdomen glossy. Frons opaque, triangle not glossy, barely shining. Legs shining black, fore tarsi brownish. Wings slightly grayish, veins thick, fuscous black. Squamæ pale brown, fringes brown. Halteres with black knob and pale stem.

Frons at vertex over one third the width of head, slightly narrowed anteriorly; orbits barely differentiated, opaque except at bases of the bristles; 4 pairs of orbitals present, the 2 upper pairs strong, the 2 lower pairs weaker and incurved; orbital hairs sparse and short; frontal triangle elongate, reaching to slightly beyond middle of frons; viewed from the side the frons is narrowly visible above the eyes; antennæ small, inserted at middle of profile, third joint rounded; arista swollen at base, slightly

pubescent, its entire length about equal to 4 times that of antenna, and nearly twice as long as width of frons at anterior margin; cheek about one sixth as high as eye, marginal hairs rather strong, upcurved above, vibrissa differentiated; face almost straight. Mesonotum with 2 pairs of dorso-centrals, the anterior pair weaker than the posterior pair; discal setulæ weaker than in *Sauteri*, and carried almost to the posterior margin of disc. Abdomen broader than in *Sauteri*. Legs strong; mid tibia with the posterior setulæ weak. Inner cross vein at below end of first vein and at middle of discal cell; last section of fourth vein 3½ times as long as penultimate section; veins 3 and 4 slightly divergent at apices; last section of fifth vein very slightly shorter than penultimate section; sixth vein reaching over three fourths to wing margin.

Length: 2·5 mm.

Type: Pilam, August, 1912.

A single example from Tainan, April, 1912, in which the outer cross vein is absent on one wing, appears to belong to this species.

26. **Agromyza atomella** n. sp.

Male: Glossy black. Frontal stripe opaque. Squamæ brown, fringe blackish. Wings clear, veins black.

Frons one-third the width of head, convergent anteriorly; orbits distinct, narrow, 4 pairs of orbitals present, the upper 2 pairs moderately strong, the lower 2 pairs weaker, incurved; hairs on orbits weak; frontal triangle broad, reaching to middle of frons; antennæ normal in size; arista as long as length of frons; cheek about one sixth as high as eye, marginal hairs weak, vibrissa slightly differentiated. Mesonotum with 2 strong pairs of dorso-centrals; discal setulæ of moderate strength. Abdomen broadly ovate. Mid tibiæ with the posterior setulæ weak. Inner cross vein at one third from apex of discal cell and at slightly beyond end of first vein; veins 3 and 4 subparallel on apical sections; last section of fifth vein about three fourths as long as penultimate section.

Length: 1—1·75 mm.

Type: Pilam, August, 1912.

Paratypes: Tainan; Takao; Pilam; Anping. Twenty specimens.

This species is variable in the situation of the cross vein, and the course of the third and fourth veins, which are sometimes divergent on their apical sections.

27. **Agromyza nigrisquama** n. sp.

This species is very similar to the above, but differs in being comparatively larger, 2·5—2·75 mm, the wings are more elongated, with the cross veins more consistently approximated, the cheek about one-third the height of the eye, and in its more robust form.

Type: Tainan, April, 1912.

Paratypes: Tainan, Takao, and Chip-Chip. Twenty-two specimens.

OCHTHIPHILINAE.

Leucopis apicalis n. sp.

Male: Black, densely covered with silvery pollen. Frons brownish, covered with silvery pollen; antennæ and arista yellow, the latter darkened apically, and the former brownish at base; palpi brown-black; proboscis yellow at apex. Mesonotum in too poor a condition in specimens to say definitely if striped, but from the fact that the setulæ are arranged in rows I infer that it should have at least distinguishable vittæ. Basal segment of abdomen without spots, second and succeeding segments with a narrow median and very small lateral black spots. Legs yellow, coxae brownish, femora, except bases and apices, black, middle of all tibiæ brownish, apical tarsal joint on all legs brown. Wings milk-white, veins almost colorless.

Frons one-third the width of head; antennæ of moderate size, third joint as long as broad, upper apical margin slightly angulate, lower apical margin rounded; arista not longer than anterior width of frons, basal joints elongated, occupying one-third of the entire length, swollen; cheek barely one third the height of eye. Mesonotum with normal hairing. Hypopygium rather large and knob-like. Legs strong, without bristles. Inner cross vein at beyond the end of first vein and slightly less than one-third from apex of discal cell; last section of fourth vein about 5 times as long as penultimate section; veins 3 and 4 convergent at apices; last section of fifth vein 1½ times as long as outer cross vein.

Length: 2—2·5 mm.

Type: Tainan, February.

Paratype: Same data.

Female: Similar to the male in color and structure except that the ovipositor is inconspicuous, and the inner cross vein is situated nearer to the middle of the discal cell.

Allotype: Same data as type.

Cryptochætum grandicorne Rondani.

Bull. Soc. Ent. Ital., 1875, p. 172.

A single example of this species, Polisha, December.

PHYTOMYZINAE.

Napomyza atrata n. sp.

Female: Glossy black. Frons opaque, frontal triangle and orbits glossy black; antennæ, palpi, and proboscis black, the apex of the latter brownish. Legs brownish-black, shining, tarsi yellowish. Wings slightly brownish, veins deep brown, fourth vein from the cross vein to its apex indistinct. Squamæ grayish, fringes brown. Halteres whitish yellow.

Frons distinctly less than one-third the width of head, orbits narrow, each about one-fourth as wide as center stripe, well differentiated; 4 pairs of orbitals present, the upper pair very strong, the others decreasing rapidly in size anteriorly, the front pair being reduced to mere hairs, orbits otherwise bare; triangle small, reaching very little beyond the anterior ocellus, but well defined; antennæ small, third joint rounded; arista almost bare, slender, its length equal to that of frons; cheek linear, slightly broadened posteriorly, marginal hairs weak, vibrissa slightly differentiated. Mesonotum with 2 pairs of strong dorso-centrals, and generally a weak, anterior pair; discal setulæ numerous, about ten rows between the dorso-centrals. Abdomen ovate, surface with short hairs; ovipositor short, slightly spatulate at apex, very similar in shape to that of *Agromyza parvicornis* Loew. Legs of moderate strength; mid tibiæ with 2 very weak posterior setulæ, as in most species of *Agromyza*. Wing venation as fig 10.

Length: 3 mm.

Type: Kosempo, November.

Male: Similar in coloration to the female, except that the tarsi are paler, and the wings are almost clear. In both the males before me the size is about 1·75 mm, and there is a yellow central organ to the hypopygium, which is very distinctly protruded. In one example the venation is similar to that of the female, while in the other the large cross vein is distinctly in front of the small one.

Allotype: Takao, October 24, 1907.

Paratype: Tainan, May, 1912.

This species has much the habitus of some of the species in the genus *Agromyza*, especially of the *parvicornis* group, and is very different from the type species of *Napomyza*, which is slender in build, and resembles thus the

species in *Phytomyza*, the great majority of which are slender species. I have located *atrata* in *Napomyza*, simply on account of its venation, which is, I am confident, not a reliable guide to the natural affinities of the species in this family, but which is the most readily appreciable, and, at present, the one most in use.

Phytomyza Fallén.

Table of species.

1. Acrostichals absent. ..... *subaffinis* n. sp.
— Acrostichals present. ..... 2.
2. Glossy black species: mesonotum with three pairs of dorso-centrals, the anterior pair very weak; antennæ with the third joind produced into a short thorn-like point at apex on the upper side; small, robust species. *spicata* n. sp.
— Black species, the thorax with dense gray pollen, abdomen shining black, with narrow pale yellow posterior margins to the segments: 4 strong pairs of dorso-centrals on mesonotum: antennæ without an acute apex to third joint: larger, slender species. ..... *affinis* Fallén.

Phytomyza affinis Fallén.

Dipt. Suec. Phytomyz. 3. 3. (1813).

A single specimen of this widely distributed species from Taihoku, April, 1912.

Phytomyza spicata n. sp.

Female: Glossy black. Frons, with the exception of the triangle and orbits, opaque black; apex of proboscis yellowish; palpi black. Legs entirely black. Wings clear, yellowish at base, veins 1, 2 and 3 brown-black. Squamæ and halteres whitish.

Frons slightly less than one-third the width of head; orbits distinct, each about one-third the width of center stripe, 3 pairs of orbitals present, the upper pair strong, the others rapidly decreasing in length anteriorly and incurved; triangle well defined, broad, reaching to middle of frons; head, in profile, with frons declevitous, face concave; antennæ inserted below middle of profile, small, third joint slightly longer than broad, its apex on upper side produced into a slight tooth; arista tapering, not much swollen at base, nearly bare, its length about equal to that of frons; cheek short, about one-third as high as eye, marginal hairs weak, vibrissa well differentiated; eye narrowed anteriorly, not round. Mesonotum with 3 pairs of dorso-centrals, the anterior pair well behind the suture, and very

weak; discal setulæ weak, about 8 irregular rows between anterior dorso-centrals. Abdomen ovate; ovipositor stout. Legs slender; tibiæ without setulæ. Second costal division $1\frac{1}{2}$ times as long as first; third, one-third as long as first; apex of costa at end of third vein and as far from apex of wing, measuring round the margin of wing, as the length of first costal division; fourth vein ending at wing tip.

Length: 1·25 mm.

Type: Tainan, May, 1912.

Paratype: Takao, April 23, 1907.

Phytomyza subaffinis n. sp.

Female: Black. Head yellow; ocellar region, antennæ, and arista black; palpi brownish. Entire thorax densely covered with gray pollen. Abdomen glossy black with the dorsum slightly gray dusted, and the posterior margins of the segments narrowly yellow. Legs black, knees narrowly yellow. Wings slightly grayish, veins distinct, brownish, fourth slightly less conspicuous than fifth, first and third very distinct, though not thickened. Squamæ and their fringes grayish. Halteres pale yellow.

Frons two-fifths the head width; orbits distinct, each about one half as wide as center stripe; three pairs of orbitals present, which decrease in length anteriorly, and in addition to these there are a few hairs nearer to the eye margin; antennæ of moderate size, third joint rounded; arista thickened, tapering to sligthly beyond middle, bare, its length equal to that of frons; cheek one-third as high as eye, marginal hairs distinct, vibrissa well differentiated. Mesonotum with 4 pairs of strong dorso-centrals, which do not decrease much in length anteriorly; disc between the dorso-centrals bare, or rarely with one or two scattered setulæ; no bristles between the posterior dorso-centrals. Abdomen elongate, surface with a few short hairs; ovipositor stout, as long as the last segment. Legs slender; tibiæ unarmed. Wings more elongate than in *spicata*, but the costal divisions similar.

Length: 1·75—2·5 mm.

Type: Chip-Chip, February.

Paratypes: Taihoku, April, 1912; Chip-Chip, February, 1912, 3 specimens; Tainan, February.

Male: Similar to the female in color and chætotaxy. The hypopygium is large and rather prominent, its form very similar to that of the species in *Agromyza*.

Allotype: Tainan, February.

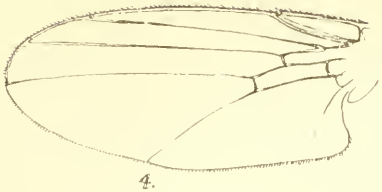
EXPLANATION OF FIGURES.

Plate IX.

Fig. 1. *Phyllomyza dilatata*, Head.
« 2. *Phyllomyza luteipalpis*, Head.
« 3. *Phyllomyza nudipalpis*, Head.
« 4. *Agromyza frontella*, Wing.
« 5. *Agromyza subpusilla*, Wing.
« 6. *Agromyza subpusilla*, Head.
« 7. *Agromyza flavofemorata*, Head.
« 8. *Agromyza frontella*, Head.
« 9. *Pseudorhicnoessa spinipes*, Wing.
« 10. *Napomyza atrata*, Wing.

Plate X.

Fig. 11. *Agromyza lasiops*, Wing.
« 12. *Agromyza nigrita*, Wing.
« 13. *Agromyza latipennis*, Wing.
« 14. *Agromyza flavisquama*, Wing.
« 15. *Agromyza flavofemorata*, Wing.
« 16. *Phyllomyza nudipalpis*, Wing.
« 17. *Phyllomyza dilatata*, Wing.
« 18. *Phyllomyza luteipalpis*, Wing.



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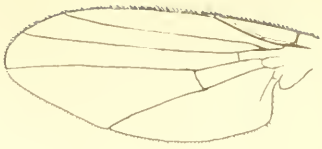

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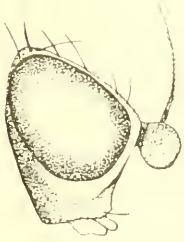

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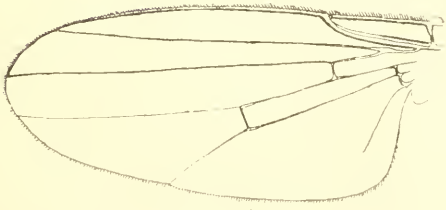

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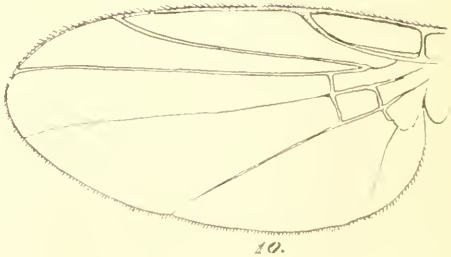

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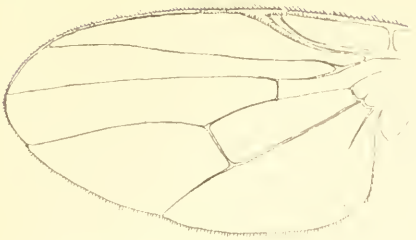

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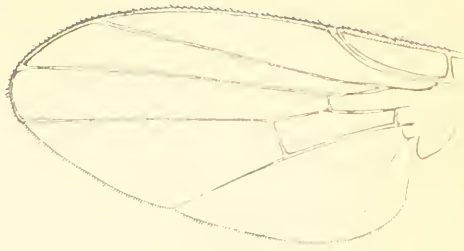

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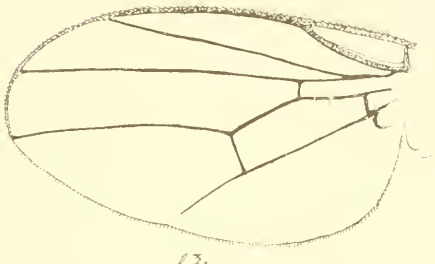

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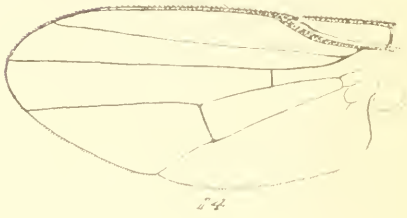

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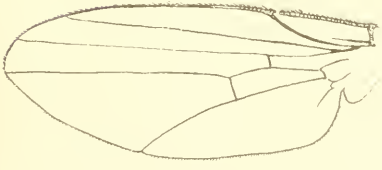

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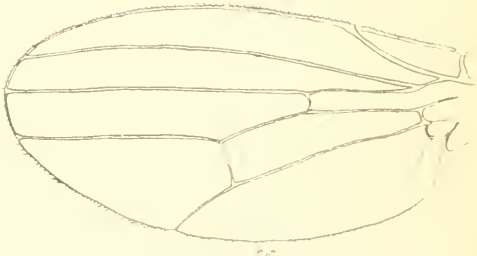

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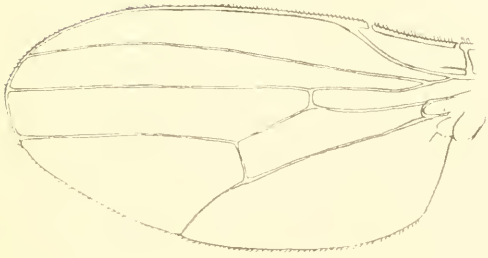

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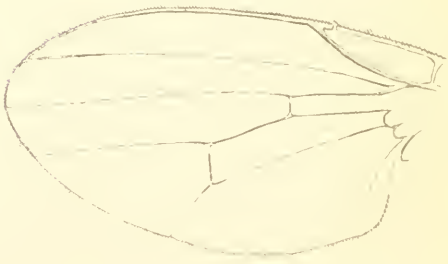

18.

FRANKLIN-TÁRSULAT BUDAPEST.

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The Chironomidae, or midges, of Illinois